20 SEPTEMBER 1957

ONE SHILLING & SIXPENCE

FLIGHT

and

AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

GLOSTER JAVELIN

Europe's Answer to Europe's Defence Problem

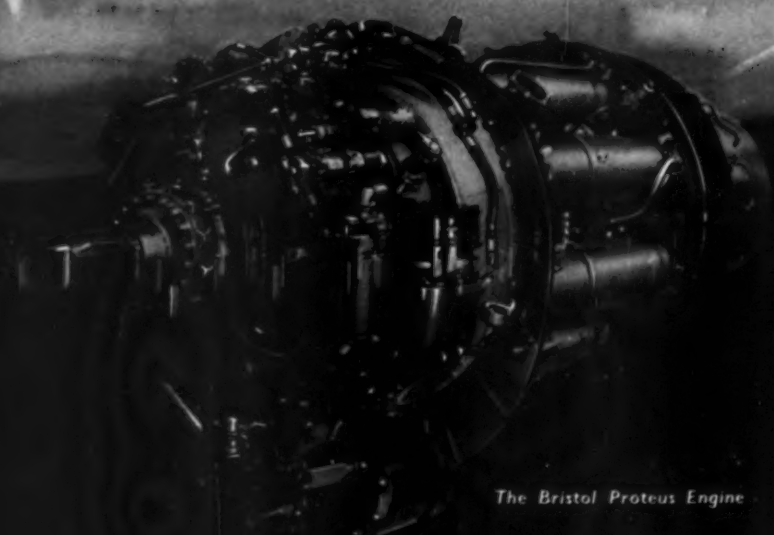
GLOSTER AIRCRAFT CO. LTD., GLOUCESTER, ENGLAND. *Member of the Hawker Siddeley Group | Pioneer . . . and World Leader in Aviation*

GLOSTER AIRCRAFT CO. LTD., GLOUCESTER, ENGLAND. Member of

Answering the Challenge

The famous Bristol Britannia airliner is one of Britain's successful answers to a world-wide challenge for dependable air travel.

Briggs are proud to supply gas turbine combustion components for the Britannia's equally famous Proteus engines, designed and built by Bristol Aero-Engines Limited.



The Bristol Proteus Engine

BRIGGS

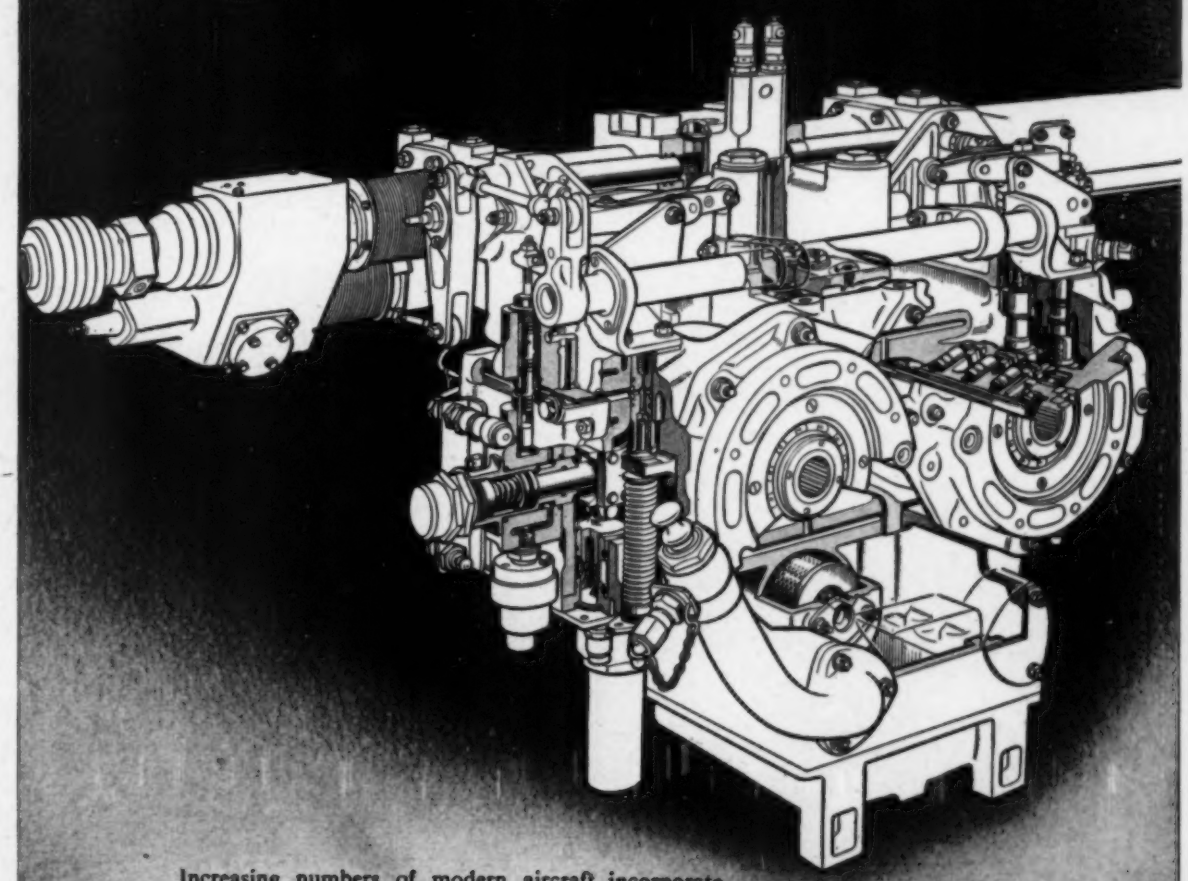
SWAYTHLING, SOUTHAMPTON

HEAD OFFICE: DAGENHAM, ESSEX

SPECIALISTS IN GAS TURBINE COMBUSTION COMPONENTS

LAND. *Member of the Hawker Siddeley Group | Pioneer . . . and World Leader in Aviation*

Power Control



Increasing numbers of modern aircraft incorporate Boulton Paul powered flying controls in their design. Why is this? Because Boulton Paul Power Controls are sensitive, accurate, stable, reliable and safe.

BPA

BOULTON PAUL AIRCRAFT LTD.

WOLVERHAMPTON, ENGLAND

P.C.19

PRESSURE SWITCHES

Pressure Switches for many applications from high operating pressure switches to units designed to indicate a differential of 0.5 to 1.25 p.s.i., meet the requirements of to-day's military and civil aircraft for warning devices, for ice accretion in fuel filters, water pressure control, oil and fuel pressure warnings, and automatic pressure cut-outs for air-borne equipment.

CABIN AIR CONDITIONING CONTROLS

ANTI-ICING CONTROLS

FUEL TANK PRESSURISATION

HOT AIR AND GAS VALVES

ELECTRO-MAGNETIC VALVES

TIME SWITCHES

PRESSURE SWITCHES

PRESSURE REGULATORS

POTENTIOMETERS, ACCELEROMETERS AND PRESSURE TRANSDUCERS

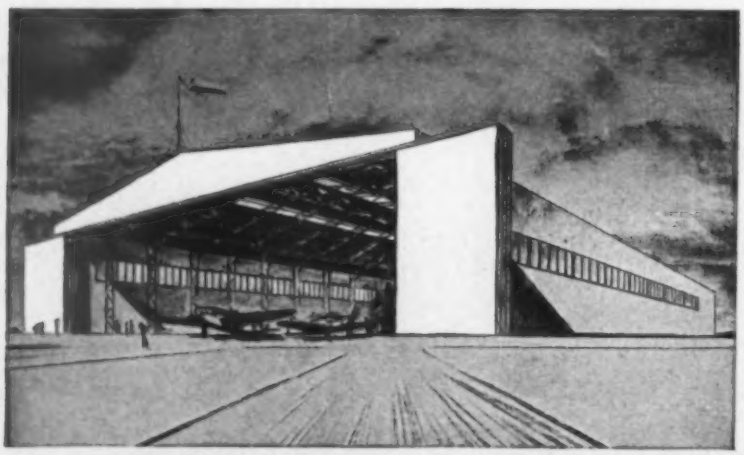
REGD. TRADE MARK

TEDDINGTON AIRCRAFT CONTROLS LTD.

MERTHYR TYDFIL, SOUTH WALES. Telephone: Merthyr Tydfil 666

LONDON OFFICE: COLNBROOK BY-PASS, WEST DRAYTON, MIDDLESEX. Telephone: Colnbrook 502

TAC164



Standard designs
200' 0" to 30' 0" spans

STEEL ECONOMY

SPACE ECONOMY

TROPICAL SHEDS & HOUSES
GODOWNS · BARRACKS · OFFICES, ETC.

We supply and erect in any part of the world.

GENERAL UTILITY **STEEL BUILDINGS** AND **HANGARS**

FOR HIRE. Erection masts 30ft. to 180ft. high. Cranes and lifting tackle.

BELLMAN HANGARS

LIMITED

DORSET HOUSE, GROSVENOR PLACE, LONDON, S.W.1 *Tel:* SLOANE 0288 *Cables: Unistruct, Sowest*

The Beaver in the Antarctic

de Havilland Beavers were chosen by Australia, Chile, Great Britain and New Zealand for operations in the South Polar regions during Geophysical Year.
The Beaver takes off on wheel-skis under critical snow-surface conditions, with half-a-ton of payload and full tanks of fuel, in a distance of 678 feet.

Designed and built by

THE DE HAVILLAND AIRCRAFT OF CANADA LIMITED

POSTAL STATION "L", TORONTO, ONTARIO

★ DESIGNED AND CONSTRUCTED TO THE MOST RIGID STANDARDS

A.I.D. & A.R.B. APPROVED

MINIATURE

Switches

AND ELECTRICAL EQUIPMENT FOR THE AIRCRAFT INDUSTRY

TYPE C330

THIS series of switches with illuminated or push-button heads can be supplied with various circuits to suit all your requirements. For miniature size and large performance electrical equipment, *consult PAGE.*

OUR PRODUCTS INCLUDE

WARNING LAMPS
TEST SWITCHES
MOVING-COIL RELAYS
FLASHER UNITS
TEMPERATURE INDICATORS
HANDWHEEL SWITCHES
CENTRALISED WARNING SYSTEMS
STEWARDS CALL SYSTEMS
INDICATOR LAMPS
MINIATURE TERMINAL BLOCKS

A typical example of our range of miniature switches shown actual size.
These switches can all be supplied with transparent or dimming type heads in various colours

PAGE ENGINEERING COMPANY

PAGE WORKS, FORGE LANE, GREEN STREET,
SUNBURY-ON-THAMES . MIDDX. TEL: SUNBURY 2642 & 2304

DESIGNERS
DRAUGHTSMEN
ENGINEERS
TECHNICIANS

Men with the right capabilities and qualifications are required for a programme of work on the design and development of high performance and supersonic aircraft.

Depending upon the appointment an Ordinary or Higher National Certificate, Degree or equivalent qualification is required. Previous experience of aircraft work is preferred but is not essential.

A new design office, laboratories, and wind tunnel will be completed in the near future and the posts advertised present opportunities to enter a strong design team with excellent working conditions in pleasant surroundings.

AERODYNAMICS Performance, Stability Control.
STRENGTH CALCULATIONS Static and Dynamic stressing and design calculations, fatigue, aeroelasticity.
SERVOMECHANISMS Electrical-mechanical aerodynamic control systems.
FLUTTER AND DYNAMICS Calculations and Test analysis involving use of analogue and digital computers.
STRUCTURAL TEST Static and Dynamic Testing including heat effects of components and complete airframes.
SYSTEMS TESTING Functional and reliability testing of air, hydraulic, fuel and electrical systems.
STRUCTURES DESIGN Detail design of aircraft structural components.
SYSTEMS DESIGN Detail design of hydraulic, fuel, and air systems.
ELECTRICAL ELECTRONIC INSTALLATIONS Design of installations of radio, navigational and other military equipment of latest types and specifications.

Write giving full particulars, quoting ref. number 9445 to:—

Personnel Officer,

VICKERS-ARMSTRONGS (AIRCRAFT) LTD South Marston Works, Nr. Swindon, Wilts.

T3421

80,000

70,000

LIQUID OXYGEN CONVERTERS

60,000

★ the most advanced way of storing breathing oxygen in aircraft

50,000

★ the new way to save weight and space

40,000

★ the way to dispense with high pressure steel cylinders

30,000

★ just one way in which the British Oxygen Company and The Aro Equipment Corporation have put their skills together to provide a valuable new service to the aircraft industry

20,000

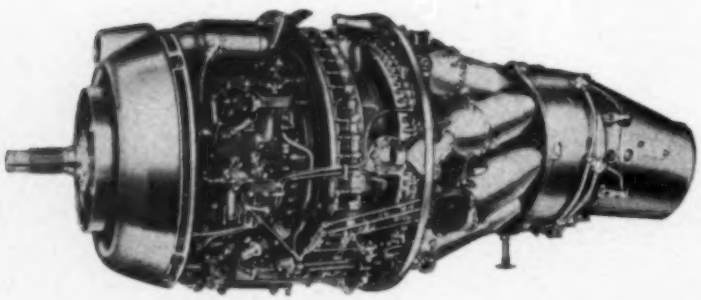
★ The Aro Equipment Corporation are leading suppliers of liquid oxygen converters to the U.S.A.F. British Oxygen need no introduction as the experts on liquid oxygen in this country

10,000

British Oxygen Aro Equipment Limited

Bridgewater House, St. James's, London, S.W.1

THE MOST PROVEN PROP-JET IN AIRLINE SERVICE



Rolls-Royce Dart prop-jets have completed over 3,000,000 hours powering Vickers Viscounts in scheduled airline service and are approved for overhaul lives of 1,000-1,500 hours.

ROLLS-ROYCE
DART
PROP-JETS

have flown over 1,000,000 hours in North America

ROLLS-ROYCE LIMITED, DERBY, ENGLAND.

FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

No 2539 Vol 72 FRIDAY 20 SEPTEMBER 1957

Editor
MAURICE A. SMITH D.F.C. AND BAR

Associate Editor
H. F. KING M.B.E.

Technical Editor
W. T. GUNSTON

Production Editor
ROY CASEY

Iliffe and Sons Ltd.
Dorset House
Stamford Street
London, S.E.1
Telephone · Waterloo 3333

BRANCH OFFICES

Coventry
8-10 Corporation Street
Telephone · Coventry 5210

Birmingham
King Edward House, New Street, 2
Telephone · Midland 7191 (7 lines)

Manchester
260 Deansgate, 2
Telephone · Blackfriars 4412 (3 lines)
Deansgate 3595 (2 lines)

Glasgow
26B Renfield Street, C.2
Telephone · Central 1265 (2 lines)

Toronto, Ontario
Thomas Skinner of Canada, Ltd.
67 Yonge Street, 1
Telephone · Empire 6-0873

New York, N.Y.
Thomas Skinner and Co. (Publishers), Ltd.
111 Broadway, 6
Telephone · Digby 9-1197

ANNUAL SUBSCRIPTION
Home and Overseas · Twelve Months, £4 10s. U.S.A. and Canada, $14.00

Entered as second-class matter at Post Office, New York, N.Y.

In this issue

473 The Folkestone Conference
478 R.Ae.S. Garden Party
479 Flying the H.D.34
482 Scimitar
488 Battle of Britain Weekend
490 Jetstar

All in the Same B.O.A.T.

WHEN it comes to selling transport aircraft in a tough, U.S.-dominated market, the British usually present a united front. B.O.A.C. have always shown a gentlemanly restraint in their public criticisms of British aircraft; and the British industry has shown similar forbearance in the face of shaky guidance from B.O.A.C. as to future aircraft requirements.

It may be argued that the washing of dirty linen in public is not the way to capture the confidence of a sorely needed export market, and that family rows should be conducted in private. But may there not be a point where patience becomes so tried that a public outburst actually does some good? The moderates would say no: the need to sell British transports in the world is too great, and our position in the market as yet too uncertain, for there to be slanging matches at home. The extremists—those who love to kick tumbling walls and who really enjoy other people's troubles—would say yes: plain speech tends to produce action.

The correct view is that public criticism *can* do good; but it should be kept within limits. B.O.A.C. allowed their criticisms of the Bristol Britannia to reach the point where someone actually felt justified in asking Mr. Gerard d'Erlanger at his Press conference last week whether B.O.A.C. wished they had never ordered Britannias at all. Only at this point did B.O.A.C.'s new chairman bring the pother firmly back into perspective. "I want to get this quite straight," he said. "The Britannia is a very fine aircraft indeed. It has strong passenger-appeal and we are very pleased with it." And later in the day, in a B.B.C. Television interview, Mr. d'Erlanger said (in so many words) that the Britannia delays might be accounted for by the fact that Bristol probably underestimated the immense task involved in bringing an advanced machine of this class into public service.

Criticisms should also be more carefully timed. It may be said that every "next few weeks" is critical for Bristol: but now more than ever does the Britannia stand on the threshold of big business, and in need of the nation's undivided support. Bristol withheld from replying to B.O.A.C., not so much because *qui s'excuse s'accuse*, but because they realized the futility of counter-recrimination, especially where their number one customer is concerned.

On balance, B.O.A.C.'s criticisms, though justified in principle, were unjustified in their degree. If the nation wants the world to fly British, it cannot afford to fly its dirty washing in public to the extent which it did last week.

Industry and Art

NO one renders a stauncher service to the British aircraft industry than do the men and women who convey its story by the graphic arts. Of this we have two reminders: the fourth annual exhibition of the Society of Aviation Artists, which we reviewed last week, and the warmth with which some recent picture-spreads and advertisements appearing in this journal have been acclaimed by readers. With new techniques of painting, drawing and photography, and with a new-found sense of the beauty and wonder of flying, the post-war school of British artists has commanded world-wide admiration and envy. Whether by "factual technical statement" (as our reviewer termed it last week) or by some vivid abstraction, the busy young men of this new school can meet their patrons' every wish. They merit—and, we believe, have been accorded—the fraternal recognition of the inter-war stalwarts whose work was so well regarded on its first appearance and which continues undiminished in esteem. In photography they face an open challenge, proclaimed with tremendous force by the incomparable scenes of the Bomber Command contrail salute at Farnborough exclusively presented in these pages last week. He would be a master indeed who could surpass such grandeur of design.

It is to the industry's own credit that patronage should have been so generously bestowed on our young artists.

SHOCK TREATMENT was given to runway photographers by these smoke-trailing Super Sabres of the U.S.A.F. Skyblazers aerobatic team. The occasion was a recent display at Marignane, near Marseilles.

FROM ALL QUARTERS

New Records

RECORDS recently homologated by the F.A.I. include the Los Angeles to New York flight by Maj. John H. Glenn on July 16 in a U.S. Navy Crusader at an average speed of 723.5 m.p.h.; the Tokyo - London flight of the Canberra P.R.7 *Aries V* on May 25 (flown by W/C. W. Hoy with F/L. P. J. Lageson as second pilot and F/L. J. J. L. Denis as navigator), at an average speed of 335.7 m.p.h.; and a distance-in-a-straight line record (1,504.6 miles) set up also on May 25 by the U.S. woman pilot Miss Jerrie Cobb, flying an Aero Commander from Guatemala City to Oklahoma City.

Suez Postscript

IN his report on operations in the Eastern Mediterranean between October 30 and December 22 last year, Gen. Sir Charles F. Keightley, who was Commander-in-Chief Allied Forces, says that two of the limiting factors encountered were the shortage of airfields in Cyprus and limited resources of air transport. As to the former, he remarks that "at the outset of the planning only Nicosia was in operation and that was under reconstruction and not working to full capacity. Akrotiri and Tymbou were developed rapidly during September and October." On air transport resources he remarks: "We had an air lift for two battalions but very limited air supply resources."

In his description of the airborne assault on November 5, Gen. Keightley says that one of its features was the "excellent support" provided by aircraft from the Carrier Force. Continuous missions were flown throughout the day and there was always a "cab rank" of British and French aircraft overhead waiting to be called down on targets by troops on the ground. He pays special tribute to the Wyverns and Sea Hawks of the Fleet Air Arm for their "extremely accurate air strike" which demolished a particular centre of resistance without damage to surrounding buildings.

In conclusion, Gen. Keightley says that "the skill and gallantry required, particularly of parachutists, commandos and pilots, was equal to that demanded in any operation of war and it is they more than anyone else who deserve praise."

Rocket *v.* Rocket

THAT it is possible for a missile travelling at nearly four miles a second to be located and destroyed when less than 190 miles from its target (i.e., about 50 sec before striking) has been suggested by Maj-Gen G. I. Pokrovsky, a Soviet rocket expert.

The thesis he puts forward—writing in *Soviet Patriot*—is not an altogether new one; contemporary methods were considered at the time of the German V.2 offensive. Once the missile has been located by radar, he says, its course and speed can be almost instantly determined by electronic computers; intercepting rockets can then be fired to explode in its path. Owing to its high speed, even small fragments from a near miss would cause severe damage, probably followed by air-friction fire and detonation.

Gen. Pokrovsky remarks that "of course, such methods require complicated design, technique and tactics." He does not indicate Soviet progress in this direction.

Poland's Aviation Week

AN aviation week was observed throughout Poland from August 7 to 14. Speaking at its inauguration in Warsaw General Frey-Bielecki, C-in-C. of the Polish Air Force, said *inter alia* that the aim was to make the P.A.F. numerically strong. While claiming great achievements for the Polish aircraft industry, particularly after the "Polish October," i.e., after Gomulka came to power, the General admitted that it would take several years before the industry would be able to build Polish-designed combat jet aircraft. But, he added, a jet trainer designed and built in Poland was now undergoing flying tests.

The central air display took place in Warsaw on September 8, when, according to a radio relay from the Bemowo Airport outside Warsaw, "over 400 bombers and fighters took part in the flying programme." These included Mig-17s and Il-28s. The *pièce de résistance* of the display was the airlifting by a helicopter of a high-performance glider, which, when released over the airport, performed aerobatics. This, claimed the commentator, was "a manœuvre never performed anywhere else in the world."

Three women members of the Polish Air Force—Maj. Irena Karpik-Sosnowska, Capt. Zofa Anrychowska and Lt. Halina Wieczorek—gave an aerobatic demonstration during the display.

On the second day of aviation week the Air Force handed over to flying clubs—free of charge—52 light aircraft (mostly CSS-13 trainers) as well as eight grass airfields, 40 fuel tankers, four radio stations, over 300 parachutes, and much other flying equipment.

During the week it was reported that a Polish-built SM-1 helicopter (Soviet licence) had climbed on September 5 to a height of 3,000 metres (9,843ft) in 7 min 41 sec. The pilot was Ryszard Witkowski.

U.S. "Integrated Flying Suit"

UNDER the control of Convair San Diego's Human Engineering Group, which acts as the co-ordinating authority for the American aircraft industry's Crew Escape System Committee, a new integrated flying suit has been developed. It is specifically designed to combine in one three-piece garment the functions previously performed by five different items, namely, survival suit, thermal liner, ventilated suit, partial-pressure suit and underwear.

The final result, illustrated on page 472 of this issue, is a three-piece suit which is a combination of conventional techniques in partial pressurization, survival and ventilation and which offers in addition some ten seconds' longer protection from fire and greatly reduced drag for supersonic ejection. Special buoyant boots have been added, together with two-piece gloves.

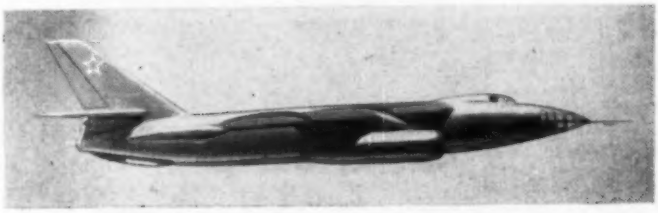
ON STAGE FOR AUDITION: The Short SC.1 on the gantry platform for engine runs preparatory to its first tethered-hovering trials. The cable leads upwards to the cross-member of the gantry.

ROYAL OCCASION: Honorary fellowship, the highest distinction that the Royal Aeronautical Society can bestow. His Royal Highness Prince Bernhard of the Netherlands here accepts this honour from the president of the Society, Sir George Edwards, on September 13, immediately before the Wilbur Wright lecture (reported on page 477).

One section of the gloves mechanically pressurizes the back of the hand when partial pressure is selected in emergencies, while the other covers the fingers but leaves them entirely free.

Present U.S.A.F. partial-pressure suits are reputed to allow very little mobility when not pressurized and to immobilize the wearer completely when they are.

A special helmet has also been designed to go with the Convair suit, offering wider visibility from the enlarged face-piece and having a ball-bearing joint at the neck which allows the wearer a full 90 deg turn of the head in either direction under all conditions. The whole equipment floats the wearer face-upwards in the water, even if he is unconscious.



BLOWLAMP is the NATO name for this newly identified light bomber, in the class of the Douglas Skywarrior, and probably supersonic in a shallow dive. Wing-tip pods house undercarriage outriggers.

The Queen's Canadian Journey

THAT the Queen and the Duke of Edinburgh will be flying in an American aircraft (a Douglas DC-7C of B.O.A.C.) when they leave on their visit to Canada and the U.S.A. next month is widely deplored, especially in the Royal Air Force. Transport Command has now amassed about 6,000 flying hours on its Comet 2s, and mileage is mounting at the rate of some half-million a week.

Anglo-American Retrospect

THE technical session of the Sixth Anglo-American Aeronautical Conference (the first half of which is reviewed on pages 473 to 476) closed at Folkestone on September 12. Though 16 papers were read in four days, attendance in the ballroom of the Hotel Metropole remained substantial throughout the lecture sessions. Delegates even found time for extra talks and demonstrations.

Lest such large-scale absorption of technical information should lead to slight mental indigestion, the Royal Aeronautical Society had arranged a Conference reception after Monday's lectures and a dinner-dance to close the session; and the Mayor of Folkestone gave an evening reception at the Hotel Metropole on September 11.

Sir George Edwards, president of the R.Ae.S., summed up the lecture session for the Society (a task which he claimed was not really possible). He thought it had been a good conference; although papers had been read "cold," security restrictions had not made them narrow or dry. The discussions had ranged widely; people had "taken very little notice" of the subject, but used the papers as a catalyst on which to base further contributions. The most encouraging feature had been that papers were mostly reports "by young chaps talking about work they had done with their own fair hands, rather than superficial statements from a great height with a thinly disguised vein of sales talk."

If there had been a discernible theme, Sir George continued, it was one of money. Researches at this time more than at any other were dependent upon dollars and cents and pounds and pennies, and some useful work had had to be stopped. Sir George was applauded for his suggestion that—as most papers had been published three weeks before the conference opened—greater use should be made of pre-reading so that longer discussions could be held.

Replying for the Institute of the Aeronautical Sciences, Mr. Mundy I. Peale said he had discussed with everyone both STOL and VTOL, and turboprops for long-range and short-range, and observed that it was obvious "you are just confused here as we are in the U.S." A suggestion voiced during the Conference for a similar occasion embracing more countries was taken up by Mr. Peale, who said that ten-nation talks arranged by the International Committee for Aeronautical Sciences (including the R.Ae.S. and I.A.S.) would be held in New York and then in France, and there was an international all-country proposal for a meeting to be held in Madrid next September. The I.A.S. is to act as a secretariat and the Council has approved the use of the Guggenheim Fund for financial support. The first honorary president (present at the Folkestone conference) is Dr. Theodore von Kármán.

The seventh Anglo-American Conference is to be held in New York during October 1959. An invitation to the R.Ae.S. to attend was extended by Mr. Peale at the dinner on September 12 and accepted by Sir George Edwards on behalf of the Society.

Glider Pilots Selected

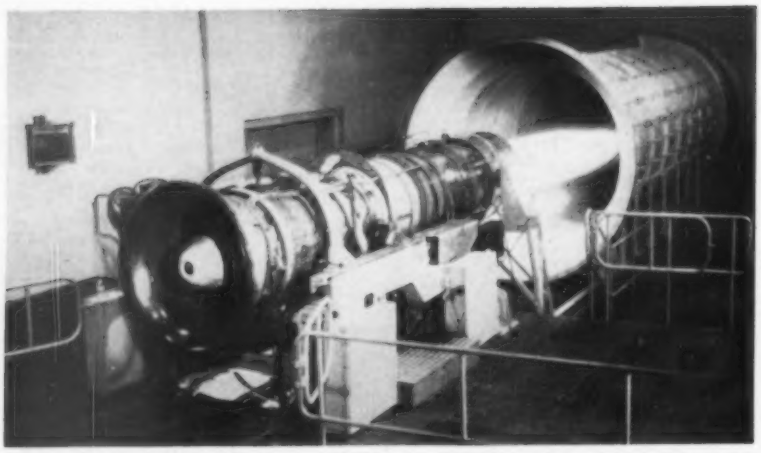
FINAL seeding of British glider pilots for the 1958 World Gliding Championships in Poland was announced last week by the British Gliding Association. The list is as follows: 1, H. C. N. Goodhart; 2, A. J. Deane-Drummond; 3, P. A. Wills; 4, G. A. J. Goodhart; 5, D. H. G. Ince; 6, G. Stephenson; 7, F. Foster; 8, J. Williamson; 9, A. Gough. It is not known at present how many pilots from each country may enter for the championships.

Delays on the Routes

SOME figures were given by B.O.A.C. last weekend about the frequency of engine changes and the resultant irregularity of their Britannia services, particularly those to the Far East where icing troubles are more likely to be encountered. In the 32 weeks since the Britannia 102 went into service on the South African and Australian routes, there have been 49 unscheduled Proteus engine changes. Of these, 16 were the direct result of damage caused by engine icing, and the remaining 33 for unspecified causes. There have also been electrical system snags.

The effect on services has been to delay seven per cent of all Britannia flights from London to Sydney between March 3 and July 20 by more than 24 hours, and three per cent by more than 48 hours. On the return journey a quarter of the services were more than 24 hours late. Since July the position has slightly improved; Sydney to London flights have experienced lateness of over 24 hours on 19 per cent of the services and on 10 per cent in the reverse direction. No flights on the South African route have been delayed by more than 24 hours since July.

RECEIVING AWARDS from Sir George Edwards are some of the recipients of R.Ae.S. honours for 1957. They are (left to right) Mr. R. L. Lickley (British gold medal for outstanding practical contribution to aircraft design and development); Mr. Caradoc Williams (Wakefield gold medal for contributions to the development and use of radio aids to navigation); Mr. Charles Abell (British silver medal for achievements in efficiency of airline operations); Mr. F. B. Greatrex (bronze medal for work on aero-engine noise reduction); and J/Tech. R. D. Trender (N. E. Rowe medal for lecture on "Parachutes and British ejector seats"). Prof. J. C. Hunsaker, awarded the Society's gold medal for aeronautical research, was—most regrettably—unable to attend the presentation of awards in London on September 13. "Flight" photographs



REHEAT OLYMPUS: As recorded in a paragraph below, and as seen here on the test-bed, the Bristol Olympus can be fitted with a fully-variable afterburner.

INTEGRATED TAILORING: The new Convair flying suit described in a news-item on page 470. It fufills all the functions normally performed by five items of pilot equipment.

HERE AND THERE

Jordan Airlift

U.S. arms for Jordan—recoilless rifles mounted on jeeps, and machine-guns—were landed at Amman from U.S.A.F. C-124 Globemasters of the M.A.T.S. and European-based C-119s on September 9. The Globemasters had flown from Delaware *via* Western Germany and went on to Dahran in Saudi Arabia before making their return flight to the U.S.A.

Exports to Morocco?

WHEN leaving this country after his recent visit, during which he went to the S.B.A.C. Show at Farnborough, Crown Prince Moulay Hassan of Morocco, accompanied by the Moroccan Minister of Public Works and Civil Aviation, said at London Airport: "When we get home we shall discuss the possibility of buying British aircraft."

Bristol/Solar Reheat

FOR the past two years, Solar Aircraft, of San Diego, have assisted Bristol Aero-Engines in the design and development of afterburner systems for the latter company's turbojets. The photograph above is the first to show an Olympus 100-series engine—probably a 102, of 12,000 lb dry rating—running at 40 per cent excess thrust with a Solar afterburner. This engine has completed the equivalent of a 150-hr test with excellent results. It is particularly worth noting that the thrust and the nozzle area can be varied continuously and progressively.

Smoky Salutations

BIRTHDAY or anniversary greetings "written across the sky over your home area" are offered by Overseas Aviation, Ltd., of St. Helier, Jersey.

"Best Foot Forward"

ON Tuesday, October 1, at 8 p.m. in the B.B.C. Home Service, James McKechnie will be heard as Colin Hodgkinson, the legless fighter pilot, in a feature based on the latter's book *Best Foot Forward*.

Show Exhibit Warning

A "VISTA" rescue mask missing from the Farnborough Show stand of Siebe, Gorman and Co., Ltd., could (the makers state) prove exceedingly dangerous if used by an uninstructed person.

German R.C.A.F. Trainees

A GROUP of 36 West German Air Force student pilots arrived in Ottawa on September 10 to begin flying training with the R.C.A.F. They form the first contingent of a total of 360 German aircrew being trained in Canada under a NATO scheme.

Coachmakers Appointments

THE Court of the Worshipful Company of Coachmakers and Coach Harness Makers has elected the following officers for the ensuing year: Master, Mr. R. J. D. Smith; Senior Warden, Mr. Victor Riley; Renter Warden, the Hon. Denis Berry; Junior Warden, Sir Reginald Verdon Smith.

Helicopter-Hunter Accident

A COLLISION occurred above East Stratton, Hants, on September 10 between a Royal Navy Whirlwind and a Hunter from R.A.F. Tangmere. The occupants of the helicopter, Lt. J. Eynon and Mr. Cyril Waine (Service liaison engineer for Alvis, Ltd.), were both killed; the pilot of the Hunter, F/O. B. J. Stephens, escaped by using his ejector seat.

SHOW IMPRESARIOS: Members of the sales and export committee of the Society of British Aircraft Constructors, photographed during an interlude in their final meeting before the Farnborough Exhibition, the organization of which was their responsibility. With them is G. W. H. Gardner, Director of the Royal Aircraft Establishment, on whose airfield the show is held. Left to right in this informal group are seen:—H. W. Goodinge, S.B.A.C. assistant director; W. A. Summers, Hunting Percival; R. C. Handasyde, Vickers-Armstrongs; H. Buckingham, de Havilland Engine Co.; Air Marshal Sir Colin Weedon, Rolls-Royce; J. W. Adderley, English Electric; C. S. Thom, de Havilland Aircraft; G. W. H. Gardner, Director, R.A.E.; W/C. J. C. G. Ball, S.B.A.C. equipment group committee; F. E. W. St. Barbe, de Havilland Aircraft; G/C. R. C. M. Collard, Handley Page; D. G. Cockburn, S.B.A.C. export officer; E. C. Bowyer, S.B.A.C. director; J. A. R. Kay, Avro; R. E. Leete, S.B.A.C. assistant director; T. C. Wallace, Alvis; C. S. Emery, Armstrong Whitworth Aircraft; F. Rowarth, S.B.A.C. equipment group committee; W. T. W. Ballantyne, Armstrong Siddeley.

THE FOLKESTONE CONFERENCE

First Two Days' Discussions at the R.Ae.S.-I.A.S. Meeting

ONE of the most interesting papers given at the 6th Anglo-American Aeronautical Conference was *N.A.C.A. Research on VTOL and STOL Aeroplanes*, by **Marion O. McKinney**, of the Langley Aeronautical Laboratory. This paper was presented on the opening day, Monday, September 9. Introducing the speaker, David Keith-Lucas, chief designer of Short Brothers and Harland, said that Mr. McKinney had been responsible for most of the N.A.C.A. work in this field. The lecturer's presentation included an impressive colour film showing N.A.C.A. model tests and a number of take-offs, transitions and landings by full-scale aircraft. Some of the main points in the work described are summarized below.

Much of the early VTOL and STOL research by N.A.C.A. was performed on the propeller-powered, vertical-attitude (or tail-sitter) configuration, in which the whole aircraft was rotated to a vertical attitude so that the propeller thrust was directed upwards for vertical take-off and landing. Models tested included those of the Lockheed XFV-1 and the Convair XFY-1. Although the models generally had unstable pitching and yawing oscillations in hovering flight, and tended towards a directional divergence at angles of attack around 50-60 degrees during transition from hovering to forward flight, it was possible to control the models satisfactorily without the aid of any artificial stabilizing device. Correlation between the stability and control characteristics of model and full-scale aircraft had been good.

Two ways of achieving vertical take-off and landing with the aircraft fuselage horizontal, both of which had been studied by N.A.C.A., were the tilting-wing configuration (in which the wing-propeller combination was rotated to a vertical position for take-off); and the deflected-slipstream configuration (here the propellers and forward part of the wing remain fixed to the fuselage, lift for vertical take-off and landing being obtained by deflecting the propeller slipstream downward by means of flaps or vanes).

The stability and control characteristics of a tilting-wing model and of a deflected-slipstream model (slipstream deflected downward through 70 deg by a 65-per-cent-chord plain flap and a cascade of auxiliary turning-vanes above the wing) had been investigated in flight tests. On the latter model transition to normal forward flight was achieved by rotating the flap upwards and retracting the vanes into a slot in the wing. The controls of the two models were the same: for hovering flight, pitch and yaw control was provided by the trailing-edge flap and roll control by varying the pitch of the outboard propellers differentially. Later investigations employed jet reaction at the tail for control of pitch and yaw.

The flight tests indicated that vertical take-offs and landings could be performed satisfactorily. It was possible to control both models in pitch without artificial stabilization, but the use of artificial damping in pitch was most desirable for the deflected-slipstream type. Transition between hovering and normal forward flight was successfully performed.

In the field of jet-powered VTOL aircraft N.A.C.A. work on vertical-attitude types had been confined to stability and control research, mainly with flying models. Early investigations employed delta models powered by electrically-driven ducted fans. A movable nozzle at the rear of the main jet deflected exhaust to give pitch and yaw control during hovering flight, and small movable nozzles in the wing (using air bled from the main duct) gave roll control. Elevons and rudder gave conventional control in normal forward flight.

Tests on such a model, a 60-deg high-wing delta, had shown that stability and control characteristics were generally satisfactory and that transition could be accomplished without the use of any artificial stabilizing device. Following ducted-fan model tests in the Langley full-scale tunnel, more-rapid transitions were made with a similar configuration powered by a ducted rocket, using the control-line technique. These tests included very rapid transitions, both accelerating and decelerating, and no longitudinal stability and control problem was encountered.

As with the propeller-driven types, there were two ways of directing the jet thrust upward for hovering in the case of jet-powered, horizontal-attitude VTOL aircraft. Flying models of both the tilting-wing and deflected-jet types were currently being tested by N.A.C.A . The research so far had shown a serious adverse ground effect on lift for the hovering condition for the deflected-jet model.

The N.A.C.A. research on jet-powered STOL aircraft had been directed entirely towards jet-augmented-flap (or jet flap) configurations. Here the entire exhaust of the jet engines was ejected downwards as a flattened jet sheet along the entire trailing edge of the wing to augment the lift of the wing by inducing additional circulation lift. A basic problem was the method of distributing the jet exhaust along the wing trailing-edge. Two methods of doing this (see figs. 2 and 3) were by ducting the air internally to a narrow slot at the trailing-edge; and by mounting the engines externally in pods and directing their exhaust towards the base of a slotted trailing-edge flap, which deflected the jet downwards over the flap in the form of a flattened sheet.

The discussion on what the chairman called "this exciting, interesting field with great promise for the future" was opened by Mr. R. L. Lickley of Fairey Aviation, who congratulated the lecturer and his colleagues on their experimental work, shown so magnificently in the film. For a transport aircraft, a helicopter such as the Fairey Rotodyne would need less power for steady level

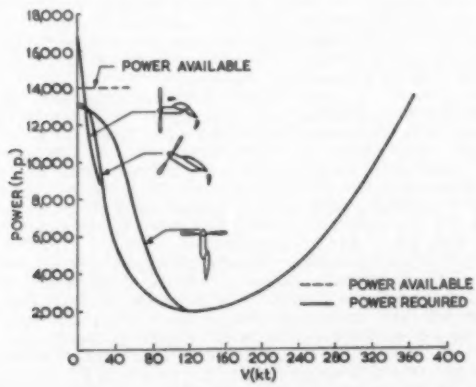


Fig. 1. Power required for unaccelerated level flight (McKinney).

Fig. 2. General arrangement of internal-flow and external-flow jet-augmented flaps (McKinney).

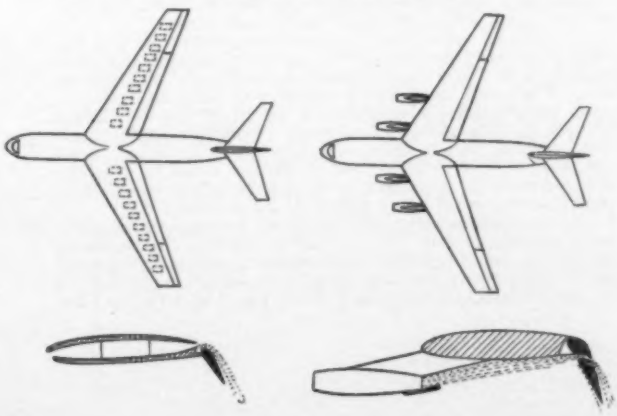
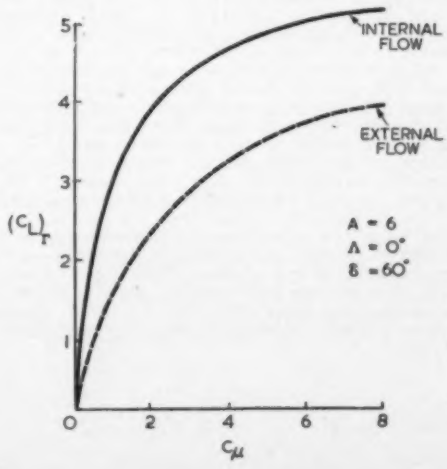


Fig. 3. Comparison of jet-circulation lift coefficient of internal-flow and external-flow jet-augmented flaps (McKinney).



THE FOLKESTONE CONFERENCE . . .

flight, compared with the types of VTOL horizontal-attitude aircraft described in the lecture, but would have a speed penalty.

Dr. T. P. Wright of Cornell Aeronautical Laboratory adapted a Stout quotation to the VTOL concept; the problem, he said, was to obtain a vehicle that would support itself financially in the air. The need was great for the final vehicle at which the N.A.C.A. research was aimed. Mr. J. J. Foody of Shorts expressed surprise that qualitative agreement between the stability and control behaviour of models and full-scale aircraft had been found: could not stability investigations be carried out, he asked, by wind-tunnel tests plus computing procedures?

Extensions of both classical aerodynamic theory and experimental techniques were required by these new concepts, suggested Mr. Raoul Hafner (Bristol Aircraft). Mr. F. H. Robertson (Shorts) asked whether calculations of the relative economics involved had been made.

Replying, Mr. McKinney said that, on the military side, there was a clear-cut need, and the ability to pay, for VTOL and STOL aircraft. Detailed studies were needed to decide the possible commercial applications. It seemed that intermediate ranges would be best suited to these aircraft, with helicopters or convertiplanes for the very short stages. An intermediate-size VTOL aircraft for stage-lengths of 1,000-1,500 miles could probably be built, but would be 50 per cent larger and more expensive than conventional machines in this class.

Interest in the subject of the lecture had been so great that an informal continuation discussion took place elsewhere in the hotel while Dr. Dunworth was presenting the conference's second paper.

At this meeting, in reply to suggestions that the free-flight model technique suffered from severe limitations caused by the higher model frequencies and low Reynolds number, Mr. McKinney stressed that the information gained from such tests was essentially qualitative. It had shown very good agreement with full-scale flight, however, when allowance was made for the effects of size on the frequency of oscillations. In contrast, simulator studies had often proved very misleading because of lack of knowledge of some of the derivatives—and in some cases important derivatives had been neglected entirely.

In connection with the optimum designs for various duties the importance of specifying the hovering time was stressed. It seemed to be generally agreed that if an appreciable period of hovering was required, or if short flights were involved, then the helicopter layout was the best choice.

It was confidently expected that military VTOL and STOL aircraft would appear in the next few years, but views were divided on the commercial side. On the one hand it was argued that the poorer direct operating costs of the VTOL aircraft would be all-important; on the other hand, the saving in both money and land for airfields, it was submitted, would outweigh the increased operating costs.

While the economics of civil-aircraft operation was undoubtedly important, it was considered that the problem of engine failure at take-off was even more vital. Interconnection of the lifting units was essential, and some reserve of thrust over weight was necessary. The attraction of having a large number of separate lifting engines as suggested by Griffith of Rolls-Royce was very evident.

Concerning the take-off and landing manœuvres, it was suggested that these should be carried out entirely automatically. The lecturer said that, in his view, the aircraft should be controllable by the pilot in these manœuvres, but he admitted that the N.A.C.A. was divided in its views on this subject.

Noise was another problem that came up for discussion. Again there was controversy, one school arguing that the VTOL aircraft would confine its noise to a smaller area, other speakers arguing that, although this was true, the aircraft would often be operating closer to densely built-up areas.

Under the chairmanship of Rear Admiral Laurence B. Richardson of the General Dynamics Corporation, the second technical session was concerned with the paper by **Dr. J. V. Dunworth**, *Nuclear Mobile Propulsion with Particular Reference to Aircraft*. The lecturer, who is head of the reactor division of the U.K. Atomic Energy Authority Research Group, said that preliminary work associated with an aircraft project would probably take several years. The design, construction and investigation of prototype and experimental systems would take several more years, and it would be unreasonable to think that an aircraft project could reach the stage of completion of a prototype in less than 15 years.

Commenting on his written paper, Dr. Dunworth said that anything that was worth saying (concerning nuclear propulsion for aircraft) was, on the whole, secret.

Admiral Richardson opened the discussion by suggesting that the first nuclear-powered aircraft might be seaplanes, for reasons of safety. Dr. T. P. Wright emphasized that nuclear aircraft were inevitable; engineers were more optimistic than basic scientists, he said, as to the time period involved. Dr. J. W. Drinkwater (Ministry of Supply) criticized the lecturer's pessimism: why should reactors occasionally suffer sudden and complete shut-downs, and were not some of the paper's weight estimates unduly conservative?

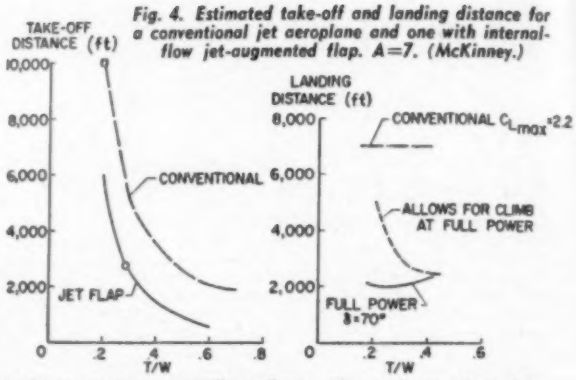


Fig. 4. Estimated take-off and landing distance for a conventional jet aeroplane and one with internal-flow jet-augmented flap. A=7. (McKinney.)

Some of the technical problems of designing a nuclear propulsion system for aircraft were raised by Mr. G. E. Preece (de Havilland Engines), who said that, in addition to establishing the technical feasibility of such a project, it must be shown to fulfil a vital military rôle or to have economic possibilities as a civil transport.

Monday afternoon's papers were both concerned with power plants, *Control of Supersonic Propulsion Systems*, by **John C. Sanders** of the N.A.C.A. Lewis Flight Propulsion Laboratory, dealing with air-intake diffusers; and *The Electrical Control of Power Plants*, by **G. M. Sturrock** of Ultra Electric, referring to the "electric throttles" of the Bristol Britannia.

The problems covered in Mr. Sanders' paper, which was presented at a session chaired by Dr. E. S. Moult of de Havilland Engines, arise from the fact that the variation in critical airflow for efficient operation of the diffuser at supersonic speeds does not correspond in general to that required by the turbojet or ramjet. Thus control of diffuser and engine to make these requirements compatible can improve aircraft performance.

In the discussion following the paper, Dr. J. Seddon (R.A.E.) emphasized that the overall control problem involved a number of specialist approaches—by the airframe and intake aerodynamicists; by the engine aerodynamicists; and by the control-system engineers. If shock-sensing was by simple tapping or probe, would there not be a boundary-layer effect? Mr. H. Pearson of Rolls-Royce described the effect of an ejector nozzle on intake matching; the ejector type appeared to have advantages over both fixed and variable convergent-divergent nozzles.

Mr. J. E. P. Dunning (R.A.E. Westcott) suggested that the engine designer should ignore the aircraft (when considering intakes) and should use pods, enabling the intake to do its job without compromise. At speeds of Mach 3-4, the matching problem could be minimized by using turbo-rockets. Mr. W. J. O'Donnell (Republic Aviation) described his company's approach which, accepting a lower value of pressure-ratio, involved the use of a known type of intake for an initial programme. Variable-area inlets had been flown, with good results.

Mr. Sanders commented that the boundary layer did tend to gradualize the pressure-change across the shockwave, but this had not affected the control. The shock could "hang on" to a probe, however. It was not known from laboratory work how important it was to guard against the diffuser operating away from optimum conditions. The suggested ejector nozzle appeared to form part of a difficult problem.

Mr. Sturrock's paper described the "electric throttles" used to control the Proteus engines in Bristol Britannia aircraft, as an example of the general approach to the problems of the electrical control of aircraft powerplants. This installation was felt generally by B.O.A.C. to be very good, only three in-flight failures of the system having been experienced by the Corporation up to September 6. Chairman of this session was Dr. E. R. Sharp of the N.A.C.A. Lewis Flight Propulsion Laboratory.

Mr. Sanders opened the discussion by pointing out that the basic assumption of temperature control demanded electronic control. With temperature control one was sensing a basic damage limit. Disillusionment with the reliability of many kinds of electrical components was emphatically voiced by Mr. D. Gerdan (Allison Division of General Motors): "Capacitors won't capacitate; resistors won't resist; and—strangely—connectors won't connect . . ." The elimination of vacuum tubes by magnetic amplifiers—or by transistors, as his own company was doing—was only the start of a long process of improvement.

Mr. Sturrock, replying, referred to the problems of magnetic-amplifier stabilization and of thermocouples; the sensitivity demanded was 0.04 mV/deg. Temperature control was accurate to ±5 deg C over the ambient temperature range −50 to +70 deg C; and his company was aiming at 100 deg C as the upper limit.

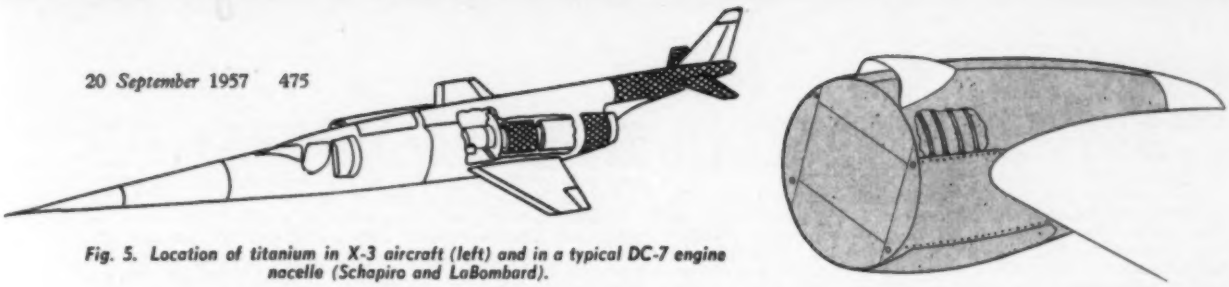


Fig. 5. Location of titanium in X-3 aircraft (left) and in a typical DC-7 engine nacelle (Schapiro and LaBombard).

The experience of titanium usage by the Douglas Aircraft Company, a pioneer in this field, was the subject of a significant paper presented on Tuesday, September 10, by **Leo Schapiro.** Co-author of the paper was **Emerson LaBombard,** and chairman of the conference session was Sir Sydney Camm, of Hawker Aircraft.

Douglas first became interested in titanium as a construction material in 1948 (the paper began) when it undertook the task of designing and building the X-3 supersonic research aeroplane. The design incorporated a turbojet engine buried within the aft fuselage. The engine manufacturer was to furnish the tail-pipe, and the fuselage and wing structure would be conventionally of aluminium forward of the plane of the tail cone. Aft of this station, stainless steel would be the first-choice material unless the then-new lightweight metal titanium could be formed to the shapes required. Improved aeroplane performance would result from the lighter weight construction, but nothing was yet known about the workability or availability of titanium.

On June 15, 1948, the first ingot of ductile titanium produced for commercial sale was melted by the Remington Arms Company at Bridgeport, Connecticut. The material was unalloyed and was termed "commercially pure." It was made available in four tempers: annealed, quarter-hard, half-hard and full-hard, and the annealed and half-hard tempers were finally selected for production use.

Laboratory tests were conducted to predict formability, and to evaluate shop-handling problems and expected dissimilar-metals corrosion problems. Procurement for aeroplane construction began, limited only by a 35 lb maximum weight per piece because of the restricted ingot size being produced. Sheets were ordered up to 44in wide, up to 108in long and in a variety of gauges from 0.016 to 0.250 in annealed temper and from 0.025 to 0.156 in the half-hard temper. For the 849 titanium parts for each of two aeroplanes, the total number of sheets purchased did not all meet the company's procurement requirements.

The failures and fabrication losses were surprisingly few considering the complete lack of knowledge and experience available at the start of production. Practically none of the losses was due to inherent characteristics of the material. They were almost entirely caused by correctable mill defects.

Stretch forming, brake forming and hydro-press forming were all tried initially as room temperature operations. As the tendency for material defects to initiate cracks became a major factor in producing usable parts, heating was applied to all of these operations, except stretch forming.

The 849 parts per aeroplane, constituting a weight of 545 lb, became the internal shroud around the tail pipe, the fuselage skin and frames at the extreme aft end and the skin and frames of the empennage. The use of the titanium parts instead of stainless steel saved 395 lb.

One material deficiency did arise after all detail parts were fabricated and assembly had started. A 0.035 gauge afterburner liner broke during shop handling, with indications of little ductility. Static tension tests with specimens cut from the part were satisfactory but bend tests were not. The microstructure was quite a surprise. The needle-shaped precipitates within the grains and the heavy constituent at the grain boundaries were the company's first introduction to hydrides.

This experience with finished parts constituting 65 per cent of the weight of purchased material was considered a satisfactory experience in the light of the material supplier's state of development, and the company next considered applying titanium to its then-new DC-7 commercial transport. Here it was planned to have the firewall and skin and frames of the nacelle of titanium, to save weight over the stainless steel used on the DC-6. Only the annealed temper of commercially pure titanium was expected to be used, as the parts to be made would give minimum forming difficulties in this temper. With the improvements effected by the material supplier, the procurement specification was modified to reflect the closer control of chemical composition then possible, but a less stringent bend quality requirement.

Stretching and brake forming became room temperature operations and parts breakage during shop handling became a new experience since they were no longer initiated by mill defects. In January 1953 it was necessary to control still more shop breakage and low notched-strength (as the latter might affect serviceability) by establishing upper limits on the mechanical properties requirements. These modifications were deemed desirable to retain the favoured room temperature forming operations and to encourage the materials manufacturers to better control of their processing operations.

Sub-zero notched testing was avidly applied during this period of shop-handling breakage and modification of procurement requirements. It was believed that this test might become suitable for distinguishing between brittle and ductile material for stretched parts. A considerable amount of such testing demonstrated that the sub-zero notched strength of the material varied from 0.6 to 1.4 ratio (sub-zero notch strength divided by room-temperature tension ultimate) and that a ratio of 1.0 might be an acceptable demarcation between acceptable and non-acceptable material.

With the addition to the procurement specification of the requirement "freedom from hydride needles in the microstructure," the company's relief was only short-lived. The lowered bend-ductility, decreased fatigue-strength and impaired ability to sustain a load in the presence of a notch with rapidly applied load at low temperatures, were all associated with the presence of hydride needles, but all these properties were not at acceptable levels when hydride needles were no longer discernible in the microstructure of newer materials. Consequent limitations included the use of a new "tear" test, and commercially pure titanium conforming to this requirement eliminated all shop breakage.

In the early consideration of titanium for a firewall, a 15 min 2,000 deg F flame test was applied to the material without any loss in strength resulting. A more practical test of the ability of this material to resist fire occurred in December 1955 when a DC-7 operating out of Rome experienced a fire on its No. 3 engine. The fire-resisting qualities were emphatically confirmed.

In the four years that 450 lb of titanium per aircraft had been flying on the early DC-7s (333 parts per aircraft), only nine parts which had failed in service had been reported to Douglas. All of these had been cracks in skins. In some cases, hydrogen in excess of the present requirements was associated with the service cracking. In one case no material deficiency was present and an engineering change to a heavier gauge was made. In its entirety, the titanium experience in the DC-7 programme was deemed sufficiently satisfactory to increase its usage on later models. The Model DC-7C now had 554 titanium parts with a flying weight of 800 lb.

It was a logical step to continue using this structural material in the turbojet-powered DC-8 civil transport. Engine shrouding and pylons were expected to use 600 lb flying weight of annealed commercially pure titanium. Rip stoppers at frames and cut-outs were expected to use 330 lb flying weight of alloy sheet, and 15 lb

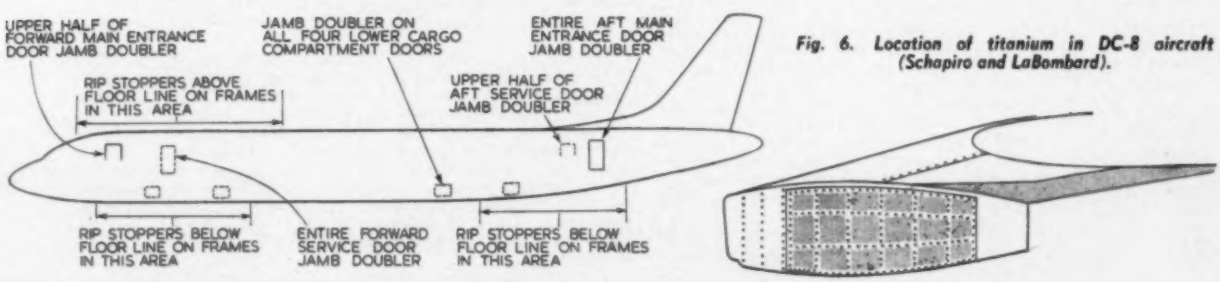

UPPER HALF OF FORWARD MAIN ENTRANCE DOOR JAMB DOUBLER
JAMB DOUBLER ON ALL FOUR LOWER CARGO COMPARTMENT DOORS
ENTIRE AFT MAIN ENTRANCE DOOR JAMB DOUBLER
RIP STOPPERS ABOVE FLOOR LINE ON FRAMES IN THIS AREA
UPPER HALF OF AFT SERVICE DOOR JAMB DOUBLER
RIP STOPPERS BELOW FLOOR LINE ON FRAMES IN THIS AREA
ENTIRE FORWARD SERVICE DOOR JAMB DOUBLER
RIP STOPPERS BELOW FLOOR LINE ON FRAMES IN THIS AREA

Fig. 6. Location of titanium in DC-8 aircraft (Schapiro and LaBombard).

THE FOLKESTONE CONFERENCE . . .

flying weight of alloy forgings were expected to complete the titanium usage in this aeroplane.

The company's first purchases of titanium were made when $20 per lb was arbitrarily set by the producer to encourage the use of the material. For the gauges and sizes purchased and the industry extra concomitant thereto, Douglas were initially paying $25 and $28 per pound of sheet. With the sponge price reductions effected by the producers in the past several years, the company was currently paying as much as $19 per lb.

The authors considered titanium usage at the latter price not fully justified for civilian aeroplanes even with the very favourable manufacturing practice with negligible losses now enjoyed. The company had continued this usage to acquire this manufacturing know-how, and looked forward to the day when a reduced material-price would fully balance and justify the continued usage of this light-weight construction material.

In the discussion which followed Mr. Schapiro's lecture, details of Short Brothers' work on titanium were given by Mr. R. Boorman. This work had included a titanium wing of a machined integral construction (manufactured "regardless of expense") which was 14 per cent lighter than its light-alloy counterpart. Mr. H. B. Howard (M.o.S.) defined the three fields in which titanium had been applied in this country: (1) as a substitute for stainless steel; (2) machined and forged detail parts, and (3) in primary structures; and asked for more information about titanium for forgings.

Maj. P. L. Teed of Vickers-Armstrongs (Aircraft) also spoke, and Capt. J. Laurence Pritchard reminded the conference that there was nothing new under the sun by quoting from the proceedings of an aeronautical conference held in 1893. At this meeting 30 U.S. papers and eight British papers had been presented, and an American engineer, R. H. Thurston, had forecast "alloys of aluminium and titanium" for aircraft. Other speakers in the discussion on Mr. Schapiro's paper included Prof. A. J. Murphy (College of Aeronautics) and Mr. A. A. Rubbra (Rolls-Royce).

Much to the disappointment of both the lecturer and the majority of his audience, Mr. Schapiro was allowed insufficient time to give a full reply to the technical points and other comments which had been aired during the discussion. He emphasized that his company had applied titanium only where its use was justified. Until recently titanium bolts had not possessed the required strength and fatigue properties; they had recently been improved, but steel bolts had been improved still further. Answers to the other questions, the chairman had decided, would be given later, in writing.

The remaining three specialist papers presented on Tuesday, all of which were summarized in our issue of September 6, were *Alleviation of Kinetic Heating Stresses*, by **James Taylor** of R.A.E. Farnborough; *The Use of Non-Metallic Materials at High Temperatures*, by **Dr. W. J. Strang** of Bristol Aircraft; and *Blast Loading of Aircraft Structures*, by **Prof. R. L. Bisplinghoff** and **Dr. E. A. Witmer** of Massachusetts Institute of Technology.

The chairman for the first of these sessions was Dr. Hugh L. Dryden (N.A.C.A.). Included in Mr. Taylor's paper was an electrical analogy for the kinetic heating of a uniform shell, in which temperature was analagous to electrical potential and rate of heat flow to electrical current. At temperatures above 350 deg C, the lecturer pointed out, the strength and stiffness of most steels began to reduce. The special steels for high-temperature use were not the strongest steels at room temperature, and they automatically involved some weight penalty. It was likely that, for speeds above Mach 5, where the saturation temperatures were about 820 deg C, the use of steel would become impracticable (because of the reduction of its strength and stiffness) unless steps were taken to reduce the temperature.

Several speakers in the discussion suggested that more attention be given to the materials, equipment and constructional methods which would be involved in actually installing the cooling devices and insulating layers. The main advantage of the electrical analogy, it was submitted, was that it gave a better physical interpretation of heat transfer in aircraft structures. Capt. Hayden L. Leon, of the U.S. Navy Department's Bureau of Aeronautics, said he was speaking as a pilot and—while the pilot would not mind his wings glowing red-hot (after all, he had become accustomed to their flexing in flight)—he would not want himself to be the "heat sink" which had been mentioned.

In Dr. Strang's introduction to his paper on non-metallic materials, he said: "In the current generation of aircraft the designer shrinks from non-metallic materials and would use metal where he could, yet it may be that speeds will be reached at which the properties of metals will be quite inadequate, and new and strange non-metallics will be developed to replace them. This paper is a user's review."

After dealing in turn with the non-metallic elements; chemical compounds; sources of heat (aerodynamic, engines, internal equipment, tyres and wheel brakes); and the various applications of non-metallic materials (plastic structures, ceramics and cermets, thermal insulation, electrical insulation, optical transparencies, radio and radar transparencies, fuels, lubricants, fuel tanks, pressure seals, adhesives, tyres and brakes), the lecturer mentioned the disturbing lack of balance in development at present (see fig. 7).

Many of the items with inadequate temperature limits were, by nature and location, difficult to cool. The one item we could not develop was the pilot and a cooled cabin must be provided, but everything else that required refrigeration in the air was an undesirable addition to the total cooling demand. Unless great advances were made with non-metallic materials, it would be these that would limit the speeds attainable in sustained operation.

Among contributions to the discussions were those by the chairman, Dr. Clark B. Millikan, of the California Institute of Technology, who mentioned Shanley's work on wire-reinforced ceramics for structural applications (the ceramic taking compression loads only, the wires taking tension); and by Mr. F. Turner of S.A.A.B., Linköping, who submitted that, compared with metals, the three disadvantages of non-metals were their lack of plasticity, lack of consistency in physical properties, and time dependency. In connection with the second of these, the effect of statistics was important—one found simply that the minimum strength of glass, for example, was zero.

The blast loading referred to in the title of the paper by Bisplinghoff and Witmer consists of the blast wave from an atomic or large chemical explosion and its effect on an aircraft in flight. In addition to developing a set of equations of motion to describe

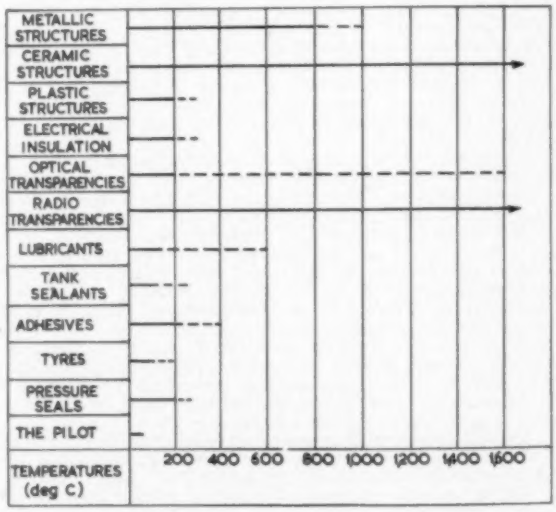


Fig. 7. Stages of development of non-metallic items (Strang).

the blast effect, the paper gave details of experimental results obtained in the M.I.T. shock tube, which was specifically designed for (a) studying blast-like loading, (b) investigating structural response to such loadings, and (c) conducting fluid-mechanics studies.

This shock tube has an 8in × 24in internal cross-section and a length of approximately 98ft. Its maximum design pressure of 250 lb/sq in absolute was chosen so as to give reasonably large Reynolds numbers for testing small models (such as a four-inch-chord aerofoil) using air as the working fluid. For such a model, Reynolds numbers exceeding one million are obtainable for shock-initiated flow Mach numbers ranging from approximately 0.05 to 1.2. The shock-tube facility at M.I.T. is owned by the U.S.A.F., who have sponsored most of the research carried out in it. The compression (high-pressure) chamber is 30ft 6in long, the distance from the diaphragm to the test section is 41ft, and the distance from the test section to the end of the expansion (low-pressure) chamber is 26ft 6in.

During the discussion of this paper, under the chairmanship of Dr. P. B. Walker of R.A.E. Farnborough, the physical sequence following a typical blast-wave was described by Dr. D. Williams (R.A.E.); Mr. Martin Goland of Southwest Research Institute suggested that the shock-tube technique was a relatively inexpensive means of obtaining much information; and Mr. M. B. Morgan of R.A.E. (commenting that the paper might seem academic but was in fact highly topical) referred to the work necessary to move from the simplified two-dimensional theory of the three-dimensional case. Dr. E. H. Bateman (R.A.E.) drew a diagram to prove that a supersonic aircraft might not be so vulnerable to blast waves in any case.

(The remaining conference discussions will be reviewed in next week's issue.)

Aeronautical Studies and Research

The Forty-fifth Wilbur Wright Lecture of the Royal Aeronautical Society

FOLLOWING the conclusion of the Anglo-American Aeronautical Conference at Folkestone, this year's R.Ae.S. Wilbur Wright lecture was presented by Clark B. Millikan, Ph.D., Hon. F.I.A.S., F.R.Ae.S., in London on Friday, September 13. Dr. Millikan is director of the Guggenheim Aeronautical Laboratory at the California Institute of Technology, and the title of his paper was *Advanced Education and Academic Research in Aeronautics*.

Chairman of the meeting was Sir George Edwards, president of the Society. After the lecture, Dr. Millikan was thanked on behalf of the Society by Mr. Peter G. Masefield and Dr. E. S. Moult.

Dealing first with the educational aspect, the lecturer expressed the need for "scientific engineers" in the aircraft industry, the armed forces, government and independent laboratories, and colleges. The training of these men should include a curriculum heavily weighted with courses in applied mathematics and the appropriate branches of physics and chemistry; and also the opportunity for original research.

A valuable section of Dr. Millikan's paper was devoted to a discussion on how to meet the above need, including curricula comparisons between Cal. Tech. and other aeronautical engineering colleges; and general remarks on the desirable factors in an effective educational programme.

On the subject of government support for academic research, Dr. Millikan gave a survey of the U.S. field. Before 1941, he said, a few university projects in aeronautics were supported by the N.A.C.A. and by certain laboratories and other subdivisions of the Army and Navy. During the war, almost the entire scientific potential of the U.S.A. was mobilized under what developed into the Office of Scientific Research and Development.

In 1946, the Office of Naval Research was established, and for five years was the only agency of the Department of Defense with the explicitly stated responsibility for supporting basic scientific research in academic institutions. The Army Ordnance Corps established the Office of Ordnance Research in 1951, its primary mission being to support basic research in fields fundamental to Ordnance technology.

The Air Force, in 1951, established the Air Research and Development Command as one of its major Commands, and went on to form the Office of Scientific Research as a part of the A.R.D.C. headquarters staff. In 1955, the O.S.R. became a separate field organization of the Command. It furnished the major Air Force support of academic research in carrying out its mission to "plan, formulate and manage the exploratory research program for the Air Force that will ensure maximum strength and efficient use of the strategic scientific potential of the United States and its allies in support of air technology."

Agency	Dollar volume (millions)	Institutions supported	Individual projects supported	Staff and graduate students supported
O.N.R. (Navy) ...	42.5 (11.8)	204 (0)	1,622 (307)	3,300 (950)
O.S.R. (Air Force) ...	16.4 (6.0)	250 (90)	650 (240)	900 (330)
O.O.R. (Army) ...	3.8 (0.2)	[125 (0) ▼	350 (8)	1,350 (50)
N.A.C.A.	0.7 (0.7)	20 (20)	45 (45)	170 (170)
N.S.F.	8.0 (0)	0 (0)	570 (0)	1,800 (0)
Total	71.4 (18.7)	—	3,240 (600)	7,500 (1,500)

Support of academic research by U.S. government agencies: approximate total figures for 1956-57 fiscal year, with figures for aeronautics and closely related fields in parentheses.

The National Science Foundation was established by Congress in 1950 with major responsibilities for the support of basic research in the sciences. In doing this it made grants to university investigators which were analogous to the research contracts awarded by the three Research Offices of the Department of Defense. In addition, however, it had a large fellowship programme for the support of graduate students in science.

The fifth of the government agencies which made major contributions to the support of academic research in aeronautics was the National Advisory Committee for Aeronautics. Its history in this respect was far longer than that of the other four. The N.A.C.A. was established in 1915, but had no facilities of its own until the opening of Langley Laboratory several years later. Thereafter, the major portion of N.A.C.A. resources was devoted to research in its own laboratories.

During recent years the aeronautical industry had begun increasingly to demonstrate an awareness of its responsibility for the training of young engineers and scientists and for the encouragement of the basic sciences which underlie its technical progress. In the academic year 1955-56, the industry's scholarship and fellowship programme totalled some $1·6m, while grants for specific projects came to $1·1m. For the past year these amounts were appreciably larger.

Three examples of research facilities at the California Institute of Technology and their support by government and industry were next given by Dr. Millikan. These were the Guggenheim Aeronautical Laboratory (G.A.L.C.I.T.) which housed Cal. Tech's graduate school of aeronautics; the Southern California Co-operative Wind-tunnel (C.W.T.), industry-owned; and the Jet Propulsion Laboratory (J.P.L.) operated by Cal. Tech. for the U.S. government.

The work at the Guggenheim Laboratory had included a study of panel flutter for the Air Force, for which experiments had been performed in the G.A.L.C.I.T. 4in × 10in transonic tunnel, the 2½in Mach 4 tunnel and the J.P.L. supersonic tunnel. Solid mechanics programmes included an investigation of the basic general-instability criteria for ring-stiffened cylinders (such as those of certain missiles), sponsored by the Ramo-Wooldridge Corporation; and a study sponsored by the N.A.C.A. of the fundamental parameters underlying the fatigue of metals.

In fluid mechanics, examples covered the range of Mach numbers from essentially incompressible to hypersonic regimes. Stability and transition in circular Couette flow was being studied wth N.S.F. support. In the intermediate range, the noise produced by turbulent boundary layers over solid surfaces (N.A.C.A.); acoustic radiation from cut-outs in aerodynamic surfaces (N.A.C.A.); and cylindrical shock-waves (O.N.R.) had been studied. In addition the Army Ordnance Corps had supported the design, construction and operation of a small hypersonic wind-tunnel.

The Co-operative Wind Tunnel was designed and constructed during the second World War by Cal. Tech. for the Convair, Douglas, Lockheed and North American airframe companies, each of which owned its own undivided interest. It was placed in operation in 1945 as a large, subsonic (M=0.95) 12,000 h.p. facility whose primary function was the development testing of new aircraft. In 1948 McDonnell Aircraft acquired an interest.

In 1951 a major alteration programme was authorized to raise the installed horsepower to 40,000 and increase the speed to M=1.8. To avoid a long and costly shutdown of the installation, complete new sections were prefabricated. In February 1955 the tunnel was shut down and the new fan and test sections moved into place. Following flow calibration and adjustments, routine development testing was resumed in November 1955.

The Jet Propulsion Laboratory was a much larger-scale operation than the other two. It had grown from a modest beginning in 1936, when a few graduate students at the G.A.L.C.I.T. initiated studies of rocket powerplants and rocket-propelled vehicles. In 1939, the Army Air Corps undertook to sponsor the programme, land was purchased in the foothills north of Pasadena ("where rocket experiments could be conducted with more convenience and less hazard than on the Cal. Tech. campus"), and the Army Air Corps Jet Propulsion Research Project was set up.

For the next few years the chief emphasis was on the development of solid and liquid propellant rockets for jet-assisted take-off of aircraft. The development of rocket-propelled ballistic missiles followed, and in 1944 the Army-owned Jet Propulsion Laboratory was established. The growth of the laboratory had been quite extraordinary and it now occupied 80 acres and employed some 1,900 persons.

The first J.P.L. missile was an uncontrolled solid-propellant rocket called the Private A. The second missile, called the WAC Corporal, was designed to carry a 25 lb payload of meteorological instruments for upper-atmosphere investigations. The Bumper-Wac was a two-stage high-altitude research vehicle in which the WAC Corporal was fired from an altered German V-2 used as a first stage.

The next in the series was the Corporal, originally designed as a fully guided research vehicle. Its development culminated in early 1954 in the acceptance by the Army of the liquid-propellant Corporal as the first U.S. long-range tactical supersonic guided missile.

Following the transfer of responsibility to industrial firms for the quantity production of Corporal missiles, the laboratory was assigned the job of developing a much-improved ballistic missile system, the Sergeant, on which it was currently working.

The supporting and basic aerodynamic facilities included a 12in Mach 4 tunnel, a 20in Mach 5 tunnel, and (under construction) a 20in hypersonic tunnel designed for M=4.5 to 8.5.

French participation: the kit-built Emeraude P.301 makes a pass over a pair of Jodels.

The R.Ae.S. Garden Party

—at Vickers' Aerodrome at Wisley

"FLIGHT" PHOTOGRAPHS

PICTURE hats—the standard garden party millinery for ladies—were not much in evidence at the Royal Aeronautical Society's annual garden party last Sunday. The few ladies so adorned had to clasp their headgear firmly in a stiffish, gusting (and chillingly penetrating) breeze; and the pilots of the daintier machines displayed had to clasp their control columns with similar firmness.

But the party was otherwise as it should have been—a summer flying display in the good-old-days tradition, with plenty of opportunity for relaxed browsing among light aircraft, new and vintage, and for the meeting of old friends away from the tensions of the weekday shop.

The hosts were Vickers-Armstrongs (Aircraft), Ltd.; and appropriately Sir George Edwards, the managing director (who with his lady received some of the 3,500 guests) is this year's President of the Society. Many of the U.S. delegates to the joint conference at Folkestone attended, and indeed the occasion had been timed so that they could do so.

Vickers were excellent hosts: the arrangements could hardly have been better. Charles Gardner provided the commentary (*causerie* is perhaps a more appropriate word) and arranged a fine indoors exhibition, which included veteran specimens from the Nash Collection, an Alcock and Brown "museum," and the D.H. Tech. School-built replica of the Wright Brothers' engine—which was actually coaxed into performing a few short, stertorous bursts.

About 40 of the 50 aircraft attending took part in the flying display, and some 50-odd visiting aircraft were counted.

Top left, Sir George and Lady Edwards welcome Sir Harold Roxbee Cox. Top right, the Turbi—built by John Britten and Desmond Norman—starts up its Coventry-Victor Neptune, for which it is a test-bed. Below left, Fairey's museum pieces—the Swordfish (Twiss) and the prototype Fulmar (Matthews)—disport themselves. Below right, the E.P.9, flown by E.P. himself gives the demonstrations which (because of its U.S. engine) it could not make at Farnborough. Other highlights were the Spitfire-Hurricane winding-match, and the Tiger Club's salute.

Day and night since 1954 . . .

High Altitude Chamber :— Temperature range + 10 to − 60°C. from zero to 60,000 ft.
A 170 H.P. 10,000 r.p.m. drive into chamber.
Sea-level chamber :— Temperature range + 20 to − 70°C.
A wide range of electrical supplies is available for both chambers.

. . . our High Altitude and Sea Level Chambers have been working for the aircraft industry

With continual and accurate anticipation of the industry's requirements, our supremacy is retained in the design, development and manufacture of electrical and starting systems.

ELECTRICAL & STARTING SYSTEMS FOR AIRCRAFT

ROTAX

ROTAX LTD., LONDON, ENGLAND
LUCAS-ROTAX (AUSTRALIA) PTY. LTD., MELBOURNE AND SYDNEY, AUSTRALIA.
LUCAS-ROTAX LTD., TORONTO AND MONTREAL, CANADA.

UNIVERSAL ROTARY ACTUATORS

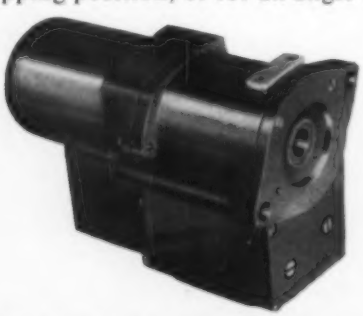
We are now in production with a Universal Rotary Actuator which greatly simplifies the work of the aircraft designer, constructor and operator.

With this design, one basic Actuator can do a wide variety of jobs—and can easily be adjusted by the customer to suit specific applications.

One and the same Actuator can be adjusted either for total rotation in either direction, or for a total angle of rotation of 180°, with a mid-stopping position, or for an angle of rotation of any lesser total than 180° (in steps of 5°) while still retaining the mid-stopping position.

The ENGLISH ELECTRIC Universal Rotary Actuator operates on D.C. of 18 to 29 volts, has a normal loading of 50 lb. ins., and embodies a high overload capacity over a temperature range of —55°C to +150°C.

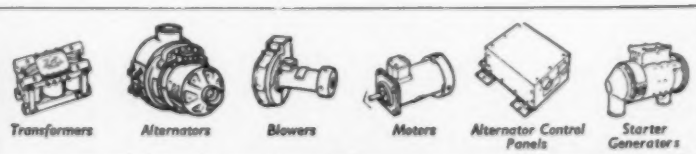
Very early delivery of these actuators can be made to meet orders. Full details and dimensions, and advice on their use, will be sent to you on request.



THE ENGLISH ELECTRIC AIRCRAFT EQUIPMENT DIVISION · PHOENIX WORKS, BRADFORD 3

A834

'ENGLISH ELECTRIC'
aircraft equipment



Flying the H.D. 34

Air Experience with the Latest Hurel-Dubois Product: a Notable Survey Aircraft

By ARCTURUS

" . . . a photographic survey aircraft with . . . a staggering payload."

A TYPICAL product of French ingenuity and originality, the Hurel-Dubois series of aircraft with high-aspect-ratio wings represent one of the earliest entries in the STOL field; and the layout is being actively developed in Britain by the joint Anglo-French company, Hurel-Dubois Miles, Ltd. The photographic survey and anti-submarine versions mentioned in this article are succeeding the first transport versions in France. This new first-hand account by a contributor confirms reports of the type's excellent handling qualities.

WHEN I first saw the drawings of the early Hurel-Dubois H.D. 31 my immediate reaction was one of shock; but those drawings played false, and so did the photographs which accompanied them. The Hurel-Dubois plan-form is not photogenic, and it is only when one sees the aeroplane in the flesh, as it were, that one is suddenly aware of its extreme, functional beauty. Anyway, that is how it seemed to me, and when I saw the H.D. 31 sitting outside her hangar at Villacoublay I knew that she was going to be "right." She didn't fail me, either. And like a lady, she was so very illogical. With both throttles against the stops she leaped from the ground as though eager to enter her natural element with the least possible delay. Yet nothing was easier than to return her to the ground, with a landing run that was almost a joke. In the air, of course, she was elegant and docile in her behaviour, and a pleasure to fly.

With this background it can be imagined how I reacted to an invitation to fly the latest product of Avions Hurel-Dubois. This is the H.D. 34 photographic survey version of the H.D. 321 transport, which itself springs from the H.D. 31. Essentially the airframes of the production H.D. series are similar, the transport H.D. 321 being the basis of them all. In addition to the H.D. 34 there are the H.D. 331, which is available in troop-transport, ambulance, police surveillance, ground attack, and vehicle transport rôles, and projected the Dart-powered H.D. 324, which is virtually a modified H.D. 321 transport. But I digress; let it suffice to say that the thought of flying a Hurel-Dubois again enthralled me.

So much has been written about the theories of Commandant Hurel that there is no need to go into the matter of high-aspect-ratio wings and their advantages. What is of greater interest is that in the H.D. 34 there exists a photographic survey aircraft with an exceptionally high degree of crew comfort, a staggering payload, and a very long endurance, coupled with the fact that the aircraft can take off fully loaded with a run of well under 500 yd from a rough grass field. With a take-off weight of 42,430 lb the H.D. 34 can fly 500 miles to its objective, undertake an eight-hour photographic mission and return to base, carrying a photographic payload of 5,270 lb. It is thus an eminently suitable aircraft for colonial survey work, which is doubtless the reason for its selection by the French Institut Géographique Nationale.

The first difference one notices between this aircraft and the H.D.321 transport is the Perspex nose, housing the navigator. Access to the navigator's position is by means of a passage-way at cabin floor level which passes between the two pilot's seats and beneath the central panel. This, of course, means that the engine control pedestal has to be discarded; all engine and propeller controls are of the plunger type and are accommodated in this central panel. A sort of shelf below the throttles houses the trim controls. The two pilots sit on either side of the central passage, raised some 2½ft, resulting in an exceptionally wide field of vision. The flight instruments are duplicated, and are well laid out and easily read; engine instruments are placed to the right of the central panel. I was particularly pleased with the trim indicators, which took the form of dials upon which the trimmer settings were clearly shown. Too often with strange aeroplanes one has to peer at obscure scales to ascertain the position of the trimmers. The whole cockpit was well-planned and functionally laid out.

The navigator's position in the nose has provision for an additional navigator seated to the left of, and slightly behind, the chief navigator. Behind the co-pilot's seat and against a bulkhead are the radio rack and the radio operator's position, facing forward, while a hinged jump-seat between the pilots allows for the carriage of a flight engineer as a member of the operational crew. In the main cabin are the two photographers, together with their equipment. Essentially this equipment consists of two large survey cameras and two oblique cameras aft, to port and starboard, and their associated film magazines. A monorail loading winch is incorporated, an arm of which can be extended outside the rear double doors when loading, for handling the magazines simply and with the minimum of effort. The cabin itself is well soundproofed and trimmed, four comfortable airliner-type crew rest seats being provided at the rear, together with toilet facilities. Provision is made for oxygen, as the aircraft is unpressurized.

The H.D. 34 has two Wright 982 C9 HE 2 engines. METO power is 1,035 b.h.p. each, while at the cruising power setting of 691 b.h.p. a cruising speed (T.A.S.) of 149 kt is obtained at 10,000ft. A somewhat unusual undercarriage arrangement is employed, in that while the mainwheels are fixed, the nose gear retracts. In the transport aircraft, the nosewheel is fixed and faired; in the H.D. 34 not only does the unit retract but it is also offset to port. The reason for the use of twin retractable nosewheels is incidental only, as the H.D. 34 uses the same airframe as the anti-submarine version (about which little can yet be written) and provision of a ventral radar scanner necessitated the retraction of the nose gear during flight, to avoid interfering with the scanner.

Having arranged details of what I wanted to do with the aircraft, M. Marchand, Hurel-Dubois test pilot, two engineers and myself climbed aboard. The plan was that M. Marchand would demonstrate the short-take-off procedure and climb, after which I should carry out general handling, and asymmetric flying, followed by take-offs and landings and a spiral climb. After starting up, the aircraft is taxied easily and precisely using the steerable nose gear. There is no runway at the Hurel-Dubois airfield at Villacoublay, the surface being grass and rough into the bargain. With the outside air temperature at 26 deg C and the aircraft at its genuine all-up weight, having just arrived from certification trials at Brétigny, M. Marchand lined-up on receiving the green from A.T.C. Let us not be in any doubts at all about this being a "bush" aircraft—at Villacoublay, apart from the length of the field, almost bush conditions obtain. A.T.C., in fact, consisted of a man with red and green flags.

In addition to external conditions of I.S.A.+11 there was no surface wind whatsoever, so considering our weight I scarcely expected anything startling in the take-off line. Neatly fitted to each control column was a Bréguet stop-watch so I decided to time the take-off run. Take-off is a simple affair indeed. With brakes hard on, the engines are opened up to full power, after which the brakes are released. At Hurel-Dubois the throttles are apparently sacred to the flight engineer; no one else touches them, so once you say the word you're committed. With the brakes released the H.D. 34 accelerated slowly, it seemed, to its take-off I.A.S. of 85 kt. From brakes off to unstick took 18 seconds; by assuming a constant acceleration as an integral and time as another, with the final speed being known, it is possible mathematically to deduce distance. In this instance, assuming the fact that the undulations of the airfield surface would cancel each other out, thus allowing for a constant acceleration, I found that the take-off run was approximately 1,300ft. Remember the conditions obtaining at the time—all-up weight 42,500 lb, air temperature 26 deg C, no wind, rough grass surface.

From unstick M. Marchand allowed the aircraft to accelerate to 105 kt, climbing at 500 ft/min. He then eased back the control column until the I.A.S. was a mere 85 kt, with the H.D. 34 climbing at 1,500 ft/min. From brakes off to 3,000ft took exactly 4 min 45 sec. At 3,000ft I took over the controls, and climbed at an I.A.S. of 85 kt to 5,000ft. With a nose-up attitude, and not far off the stall, the aeroplane inspired immense confidence: the controls were pleasant and responsive and there was no tendency to wander.

My French, although passable for the ordinary things of life, is

FLYING THE H.D.34 . . .

not adequate for technical conversations over an aircraft intercom. The result was that, on levelling out at 5,000ft and starting a Rate 3 turn, I noticed that the crew had suddenly become talkative, with frequent gesticulations at the sky and utterance of the word *"planeur."* As it was a particularly fine day, dotted with fair-weather cumulus, I assumed that they were commenting proudly on the fact that their sky was so beautiful. I therefore enthusiastically agreed, and continued to throw the aeroplane around the French sky—until out of a nearby cumulus popped a glider, heading our way. *"Planeur!"* yelled the crew again. *"Planeur"* echoed I, nodding wisely and breaking away smartly to port. Apparently we were practically on top of the local Lasham.

Turns are accomplished easily on aileron alone, top rudder being needed only in the very steepest. I found that for such a long-span wing the aircraft possessed a surprisingly high rate of roll, although I omitted to check on the exact rate. There is no lag on the application of the ailerons, either, a small amount of aileron immediately producing the desired bank angle. In the case of the H.D. 31 low-geared ailerons were incorporated, and I remember that almost half a turn of the wheel was needed before the aircraft would respond.

I had been told by Emile Escande, sales director of Avions Hurel-Dubois, that the H.D. 34 was unstallable. It seemed fitting that this claim should be put to the test, so I asked the high-priest of the throttles to close them. This accomplished, I hauled back on the control column. At first nothing happened, except for a sensation of deceleration, and the adoption of a slightly nose-up attitude. The controls were quite soggy, and the aeroplane then developed a gentle wallow, rather like a boat in a gentle swell. The I.A.S. dropped to 65 kt and a high rate of descent developed. By easing the control column right forward the nose could be made to drop and control speed immediately be regained. On two other attempts to stall the aircraft, one of them with flaps out, precisely the same thing happened, although in the case of the flaps-out stall I noticed a slight tendency for the nose to drop.

Having satisfied myself regarding the correctness of the claims made for the stalling characteristics of the H.D. 34, we headed back to Villacoublay for a demonstration short landing. I reduced to circuit height and speed, and the flaps were progressively extended by M. Marchand from the end of the downwind leg, on the cross-wind or base leg, and fully out on finals. The initial circuit and approach speed was 100 kt indicated, and on base leg and finals I was told to keep the airspeed at 80 kt. With each alteration of flap setting and reduction of power very little change of trim takes place. By maintaining a constant I.A.S. of 80 kt the H.D. 34 can easily be trimmed so that it practically lands itself.

M. Marchand gave me an effective, if somewhat disconcerting, demonstration of this stability. Just as I was coming over the hedge, and feeling somewhat pleased with myself, he seized the controls with a grin and waggled them furiously. The effect was practically unnoticeable, and the aeroplane carried on to make a positive landing. Under these approach conditions there is no flare-out, although I hauled the control column well back. This has the effect of inducing the high descent-speed mentioned earlier, together with a reduced forward speed. All three wheels touch practically simultaneously, the nosewheel leading, if anything. At the same time the brakes are applied fully and the mass of aeroplane comes to a sudden *arrêt*. I timed the landing run by means of the stop-watch and found it to be 12 sec from wheels-on to a complete halt. Relating the integrals of speed and deceleration to this time an approximate figure of 175 yd results, although in fact it seemed even less.

For normal operations, of course, there would be little point in employing such techniques, as the wear and tear on tyres and undercarriage must be considerable. But even using a faster approach, with flare-out, I gained the impression that the H.D. 34 would use very little aerodrome. The real value of this short landing and take-off is to be found when the aircraft is called to operate from short, high-altitude strips, which is undoubtedly one of the main reasons for its choice by the Institut Géographique Nationale. One can readily envisage this quality paying off well if the aircraft is called upon to undertake survey work in Algeria, or French Equatorial Africa, for example. For the same reason, therefore, it is worth recording the spiral climb from take-off technique, for use in mountainous territory.

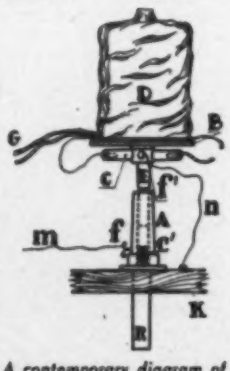
M. Marchand demonstrated this technique to me next. First of all, the same take-off procedure as before was adopted, and a similar time was noted. But immediately on take-off, M. Marchand threw the H.D. 34 into a right-hand climbing turn, well inside the airfield boundary. He then handed over control to me, instructing me to maintain the turn and climb. In just over 4 min we climbed to 3,000ft entirely within the vertical boundary of the aerodrome, and with the engines at METO power. During this impressive ascent the aircraft remained completely tractable and fully responsive. I confess that when I saw Issy-les-Moulineaux ahead I felt sorely tempted to try a landing and take-off, if only to steal the Twin Pioneer's thunder. But my thoughts were read by M. Marchand, who emphatically pointed out that Issy was for helicopters only. And so we returned to Villacoublay, for another of those fantastic landings—fantastic because of the 42,000 lb of aeroplane that was doing it.

I left the H.D. 34 regretfully, for I would like to have spent a lot more time with her. I certainly believe that this is one of the aircraft that will make its mark in the aviation world, not only as the H.D. 34, but in its other rôles as well. With increasing interest in STOL aircraft for short-haul feeder services the H.D. 321 transport is worthy of very serious consideration, for on such services speed is of secondary importance, the first being proximity to the city of the aerodrome. Many operators are searching for a DC-3 replacement; I suggest that in the H.D. 321 an answer is to be found. With nearly double the seating capacity, a similar cruising performance, and the ability to use fields that are closed to the DC-3, little else could be asked for.

EJECTION FORTY-FIVE YEARS AGO

A PARACHUTE release system which might in some degree be regarded as the ancestor of the modern ejection seat was demonstrated at Issy-les-Moulineaux, near Paris, as long ago as December 1912. Staged by an Austrian, the Baron d'Odkolek, the first demonstration took place in the Astra hangar (Astra were an airship firm) on December 12 of that year before numerous spectators, including a French military commission.

For the first trial a roughly made wooden model of a monoplane, carrying a dummy pilot weighing 60 kg (132 lb), was hoisted under the hangar roof to a height of 60ft. The operating principle was simple enough, though the pilot himself, rather than his seat, was intended to be ejected. The arrangement is shown in the sketch. A is a gun mounted on a suitable part of the fuselage K, and having a recoil cylinder R. The gun is loaded with a cartridge c' and a spigot E carrying a tray B on which is the folded parachute D, with lines G attached to the pilot's belt. At c is a triple gun with barrels spaced radially at 120 deg and intended to fire three lines outwards to deploy the canopy. The theory was that the pilot should pull the lanyard m, withdrawing the striking pin f and firing the main gun. As the spigot left the barrel the static line n would be tightened, so actuating the firing pin f' of the triple gun to entend the canopy.



A contemporary diagram of d'Odkolek's device.

Oddly enough, the theory worked. The dummy pilot being unable to pull the main firing string for himself, M. d'Odkolek did so, and (according to a contemporary account) "the mannequin [i.e., the dummy] came down quite slowly, supported by the parachute fully opened."

But the French commission, wise in their generation, were not fully satisfied; they demanded that the device be tested from a moving vehicle. So a week later, at Villacoublay Airfield, a test was made with the aid of a sports car provided by the French aircraft constructor Hanriot, the weight of the dummy being increased to 85 kg (187 lb). This pioneer attempt at ground-level ejection was equally successful: "The parachute was fired from the motor car moving at full speed and the mannequin was ejected, descending quite slowly to the ground."

Fortunately, perhaps, full-scale trials with a live pilot were never attempted.

V.A.H.

THE ART OF DRIVING

ROADCRAFT—as distinct from the elementary procedures of making a motor vehicle start, follow a given course, and stop—is the main theme of a book* which has recently appeared in a revised and enlarged second edition. The author, S. C. H. ("Sammy") Davis, has been a driver from the earliest days of motoring, and in the inter-war years his skill earned him a place in the famous Bentley racing team. In *Car Driving As An Art* he passes on his experience to the reader in a characteristically entertaining manner. The absolute beginner is not overlooked; but, equally, the driver of many years' standing can learn something new from almost every page.

*"Car Driving as an Art" (a Guide for Learners and Advanced Drivers). Illustrated. Published for "The Autocar" by Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 12s 6d (by post, 13s 7d).

FAIREY Fireflash

The first British guided weapon.

Now with the Royal Air Force.

A Vickers Supermarine Swift fitted with two Fireflashes.

THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

ENGLAND · AUSTRALIA · CANADA

E

FIRESTREAK

The infra-red homing

air-to-air guided weapon

now in production for

THE ENGLISH ELECTRIC P.1

THE GLOSTER JAVELIN

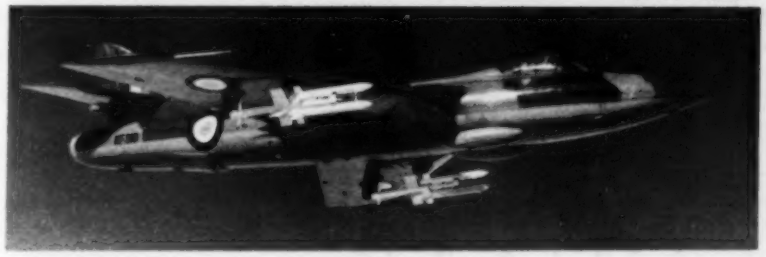
THE D.H. SEA VIXEN

DE HAVILLAND PROPELLERS LIMITED

HEAD OFFICE: HATFIELD, HERTFORDSHIRE

Southern Factories: Hatfield, Stevenage, Edmonton
Design Offices: Hatfield and London

Northern Factories: Lostock, Farnworth, Walkden
Design Office: Manchester



"Flight" photographs

Comparative views of the two missile-carrying Hawker Hunters. XF 378 (top) is a modified Mk 6 with long radar nose and carries two de Havilland Firestreaks. XF 310 is a Mk 4, with two Fairey Fireflash.

AIRCRAFT INTELLIGENCE

U.S.A.

Douglas C-133A. As yet unnamed, this big, four-turboprop strategic transport by Douglas Long Beach division (*Flight*, February 17 and April 27, 1956) is about to go into U.S.A.F. service. Eight are now engaged in Phase VII testing with the Military Air Transport Service, and one will soon be seen in England (at Burtonwood and possibly other airfields) on a tour of U.S.A.F. establishments in Europe and North Africa.

Republic F-105 Thunderchief. It is pointed out by *Aviation Week* that the curious double-shock intakes of this big fighter/bomber operate with internal compression and thus have lower drag than comparable external patterns (such as the simple centre-body forms fitted to the F-104 and B-58). The Thunderchief intakes are of a pattern ascribed to Ferri, and suggested for ramjets. A sketch appeared in our issue of May 31.

Republic F-84 Series. With the virtual completion of production of this famous family at Farmingdale, Republic Aviation have announced the total number so far delivered of each major sub-type. Straight-wing Thunderjets, chiefly of the F-84E and F-84G models, numbered 4,457. The swept F-84F Thunderstreak totalled 2,711 and the total number of camera-equipped RF-84F Thunderflashes delivered was 715. The grand total for the family is thus 7,883; which prompts the reflection that if the company make one-tenth as many F-105s they will be doing extremely well.

Grumman F11F Tiger. Now entering Fleet service, the latest version of this small supersonic fighter is distinguished by a longer nose, of improved profile. The nose terminates in a gunsight radar and dielectric tip, replacing the flight-refuelling probe of earlier models (the latter device has been relocated elsewhere).

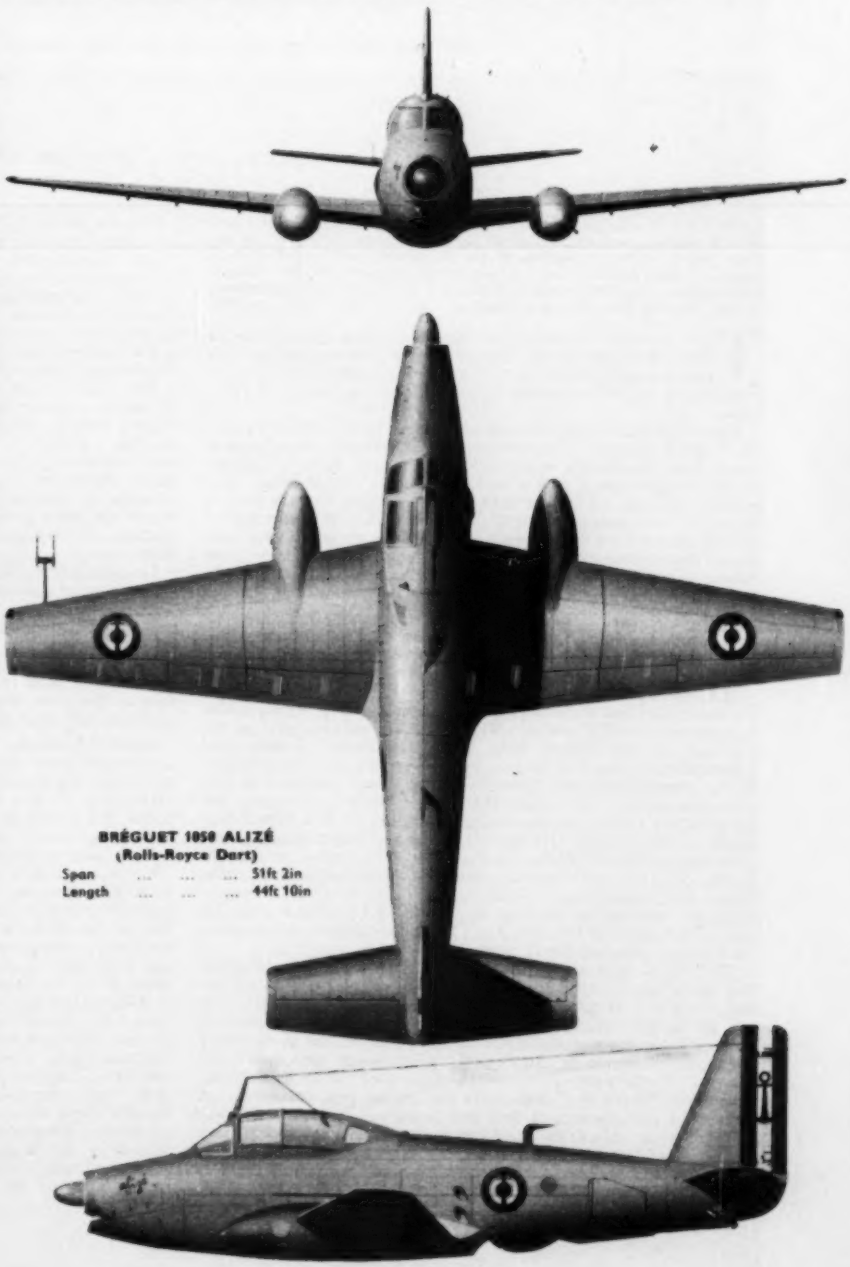
France

NATO Contest. The NATO contest for light tactical-support aircraft was due to begin at Brétigny-sur-Orge on September 16. Entries are the Bréguet 1001 Taon, Dassault Etendard VI, Fiat G91, and S.E. 5003 Baroudeur. The contest is now known as the LWSFC (Light Weight Strike Fighter Competition).

Paul Aubert Six-Seater. Having laid down a production line of 30 four-seat PA.204 Super Cigales (the first examples have already been delivered), the Paul Aubert concern are now completing studies of a high-wing, twin-engined aircraft (Lycomings of 180-240 h.p.) seating six persons. Construction would be composite metal and wood, and the undercarriage would be retractable.

Czechoslovakia

L-200. The Kunovice Engineering Works has recently completed the prototype of a new light transport, the L-200. A twin-engined, low-wing, all-metal monoplane, it is said to seat five in a "luxurious" cabin, and to cruise at 160 m.p.h. The wings have anti-icing equipment. Full-scale production will start in 1958.



BRÉGUET 1050 ALIZÉ
(Rolls-Royce Dart)

Span	... ...	51ft 2in
Length	... ...	44ft 10in

SCIMITAR

"Flight" photograph

A Revealing Description, and Notes on Deck Landing

RARELY is it possible to publish such a detailed description of a new British military aircraft as that of the Scimitar given below. It has been reprinted by permission of the Admiralty, and is followed by notes on deck-landing and catapulting trials provided by Vickers-Armstrongs, whose Supermarine Division is, of course, the manufacturer of this remarkable new fighter/bomber, soon to enter F.A.A. service.

THE Scimitar is one of the two fastest and most powerful single-seat aircraft coming off the production line in this country, and will be the first of the new generation. Service intensive flying will start shortly and the first squadron will form later.

Compared with current single-seat Naval strike/fighter aircraft the Scimitar is large. This larger size has, broadly, three causes; nearly twice the weight of useful load is carried; there is a higher thrust/weight ratio giving a very high initial rate of climb, and greater range and endurance is provided. Further, the aircraft has plenty of development potential. A wide variety of equipment is already planned for the different rôles, and design studies for continued improvements are under way. These are possible because recent tests with the blown flap have been very satisfactory, and the aircraft is well within the limits of the ships' gear.

Cockpit Layout. Starting at the port side aft, there are two long levers operating the L.P. fuel cocks, with relighting circuit breakers on their right. Forward along the console we have the emergency flap/undercarriage/hook levers, and the I.F.F. and V.H.F. control boxes. Immediately aft of the throttle quadrant are the rudder and standby tailplane trimmers. The throttles also incorporate the H.P. cocks. The relighting switches are on the rear face of each throttle lever and the starboard throttle grip houses the airbrake and "press-to-speak" switches. The airbrakes are at present infinitely variable but are being modified to two positions—in or out. Forward of the throttle quadrant are grouped the engine starting switches, and above it is the sliding hood control switch. To the left of the main instrument panel, from top to bottom, are the arrester hook lever, cockpit emergency lights, flap and undercarriage controls, undercarriage warning lights and brake gauge. Alongside the flap lever is a desynn indicator showing trailing edge flap angle, and next to it a similar type of indicator for the airbrakes. (This will later be changed to a "doll's eye" showing white when airbrakes are out.)

The engine instruments and fuel presentation are on the right of the main panel. Each fuel tank is individually gauged on the long bank of vertical-scale indicators. The pointers for each tank are all in line when the fuel balancing system is functioning correctly. In the event of it not doing so the fuel can be manually balanced by means of the three-position switch underneath the gauges. To the right of this switch can be seen the cabin altimeter and three "doll's eye" indicators for engine fuel pressures. A flowmeter showing rate of flow and pounds of fuel gone will also be fitted here. Above the main fuel indicators is a "totalising" fuel gauge which reads the last 2,000 lb. Alongside are two J.P.T. gauges. The two instruments next above are the r.p.m. indicators which are now calibrated in per cent r.p.m.

Coming down to the starboard console forward there is the centralized warning system, comprising a total of ten potentially "vital" failures—cabin pressure, wing fold, two generators, two hydraulic pressures, compressor port and starboard, and fire warning port and starboard. In the event of a failure of any of the above items the main attention-getter lights flash red—these are in the front top corner each side of the cockpit. The pilot then refers to the panel to determine the exact nature of the failure, cancels the flashing lights and takes appropriate action.

Aft of the C.W.P. are bomb and R/P selector switches, audio approach, stores jettison, pressure cabin switch, cabin temperature control (which is fully automatic) and oxygen panel—the latter also has a remote indicator in the centre above the main instrument panel—wing fold lever, g-suit control, etc. The transverse panel above the main instrument panel is being extensively rehashed to incorporate radar navigation and sighting devices. Below the main panel are the trim indicators, pitot heat switch, instrument early-start switch and over-ride switch for use with drop tanks.

Longitudinal and lateral trim is obtained by the four-way switch on the control column, and there is also a standby tail trim switch on the port console. The trim indicators are "doll's eyes" and are trimmed white for take-off, but all go black when the weight comes off the undercarriage legs. The brakes are toe-operated, and may be parked by pulling out the T-lever.

The hood is force-jettisoned by pulling the lever on the inner side of the port console. Pulling down the ejection seat blind automatically fires the hood before the seat.

Control Systems. The control system has remained basically unchanged since the first flight, and consists of rod/cable runs operating the valves of hydraulic actuators. Feel is provided artificially. It is a straightforward system, with a minimum of tricks and gimmicks.

Pitching control is obtained from a tailplane operated directly by a tandem actuator. There are no elevators or tailplane flaps. The two cylinders of the actuator are fed by entirely separate hydraulic systems. Full operation on either system alone is possible except at supersonic speed, when there is a small reduction in the available g. Since each hydraulic system is provided with two pumps, one on each engine, the failure of one system will not occur due to an engine or drive shaft failure. Coming forward from the actuator, one passes the flap-operating link—a non-linear gearing—to arrive at the artificial feel system, which is under the cockpit floor. Duplication of artificial feel is arranged so that failure of one system will not be felt by the pilot. Twin hydraulic jacks provide the feel forces, which are varied by E.A.S. and Mach number pressure capsules. At low air speed a constant jack "base pressure" gives effectively a plain spring feel. At speeds above 300 knots E.A.S. the pressure increases with speed to remain proportional to q. Above $M=0.9$ this pressure is biased by the Mach meter capsule to prevent the gradual "stick heavying" which would otherwise occur.

The ailerons are also operated directly by tandem actuators

using the two independent hydraulic systems. Again unlimited operation on either system alone is possible, except at supersonic speed, where the available rate of roll is reduced. The actuator valves are operated by push-pull rods and cables via a small actuator. The two hydraulic systems also feed this actuator which is used for overcoming the circuit friction so as to give very low break-out forces at the stick. Feel is provided by a simple spring that does not vary with speed. The electric trim actuator provides a bias to this spring.

The rudder is little used at high speed and one hydraulic system provides actuation and q feel. Reversion to direct pedal control is used if this one system fails. Engine failure and landing with one engine on pedal control causes no headaches. The flaps are operated by a link in the tailplane control system, in order to move also the tailplane and maintain the aircraft in trim. As the trailing edge flaps go down, the nose flaps and "blow" come into operation. For landing the flaps come full down and bring in the fuselage flaps. For take-off or overshooting, drag is reduced without any noticeable change in lift by partially raising the flaps.

Handling. *(a) Catapulting.* The aircraft is pulled hard down on to its tailskid for launching at an attitude of 12 degrees which, surprisingly, feels quite comfortable and normal. Flap blowing is used for the catapult take-off because the extra lift available more than outweighs the loss of engine thrust; the minimum launching speed is about 10 knots less with blow on than off. A further reason for using blow is a marked improvement in fore-and-aft controllability.

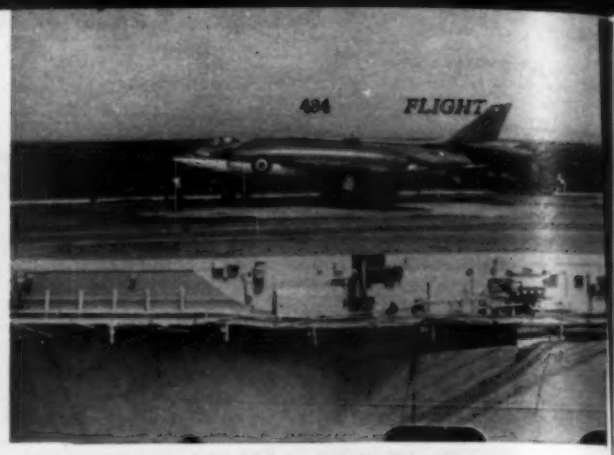
So far the aircraft has not been catapulted with external stores.

(b) Climb: high-altitude handling. When climbing at the best climbing speed the aircraft is difficult to control accurately in pitch. The reason for this is that it suffers a nose-down trim change corresponding to a degree of tailplane angle in going from M = .85 to .95. The position is aggravated by inadequacies of the tail actuator system which are manifest to the pilot in the form of a slight lag from stick movement to aircraft response. A similar problem exists on the aileron control, making it difficult to fly the aircraft level with the degree or precision one would like. As a result both the tail and the aileron controls have been subjected to a "five-star" flight test programme.

The departures from straight and level flight referred to are extremely small and in no way limit the aircraft—in fact the problem does not exist at higher speeds. Most noticeable is the disappearance of the buffet boundary when pulling g at transonic speeds. The buffet boundary is low at subsonic speeds up to .95 but at supersonic speeds quite high g can be pulled without a sign of buffet. The pitch-up problem—the *bête noire* of modern aircraft—has been transformed by the anhedral tailplane which is now fitted to all Scimitars.

[Contd. overleaf

"The control system has remained basically unchanged since the first flight . . ."



Secured during two different series of trials, these views convey (right to left) an excellent idea of landing-on and launching.

SCIMITAR . . .

(c) Descent. The airbrakes consist of six petals (three each side) on the aft engine nacelles which open outwards through 80 degrees. Extension of these causes a slight buffet at medium speeds, none at all at high speeds, and they decelerate the aircraft from 500 knots to 250 knots in 45 seconds.

(d) High speed: low level. At present this condition has been only briefly explored, but a "sprint" into the target will be possible at nearly Mach 1, when carrying the bomb and drop tank. A feature of the aircraft is the enormous strength for this rôle, the design diving speed, for example, being supersonic at sea level. Other than for the "sprint" an economical cruising speed of about 400 knots would be used. The range of "loiter" time can be extended by dousing one engine. The directional trim change resulting therefrom is negligible and no one has yet failed to relight a serviceable Avon at low level.

(e) Landing-on. A brief description of the flap blowing system may not be out of place here. The jet of air, blowing aft from a fixed nozzle, follows round the surface of the flap to flow downwards and aft. This deflects a large mass of air and about doubles the effectiveness of the flap. The effect of blow, coupled with increased flap area, was proved during recent trials to have reduced the approach speed of the Scimitar very considerably (compared with the double-slotted flap version). Apart from this very acceptable speedwise improvement there were some very satisfactory gains from the handling viewpoint, namely a more nose-down attitude, excellent engine handling (r.p.m. on the approach averaged 84 per cent) and improved longitudinal stability. As already mentioned, audio approach is fitted and was tested on the recent deck-landing trials in H.M.S. *Ark Royal*, with very satisfactory results. Both longitudinal and lateral control is very powerful and effective on the approach, two most necessary ingredients of a good deck-landing aircraft.

Programme. The first prototype Scimitar flew in January 1956. The first series of deck landings took place in *Ark Royal* in April 1956. Both the second and third prototypes, and the first production aircraft, flew within 12 months of the first aircraft. There were seven aircraft engaged on development flying by June 1957 and a Service Intensive Flying flight will form before the end of the summer. Formation of the first squadron will follow a few months afterwards.

Development flying will clear the basic aircraft and the wide variety of alternative equipment carried in the different rôles. While early aircraft should be operationally effective, continued development is planned. For example, a new navigating system will improve the strike rôle and an alternative armament to the four 30 mm cannon will improve the aircraft in the fighter rôle. Both these rôles will be aided by the introduction of an autopilot. Further developments are being actively pursued. Besides these two principal rôles the Scimitar is intended also for fighter reconnaissance and ground-attack duties. In the former case the folding nose is unpinned and a camera nose added.

These alternatives and additions have resulted in little increase in the aircraft's weight. The basic airframe is being continually refined as production continues and over half the weight is military load and fuel.

The fact that a Naval aircraft is now one of the country's two fastest single-seaters is a tribute to the careful planning laid down some years ago in D.A.W. and the close liaison with the Ministry of Supply.

Landing and Catapulting Trials

The third prototype aircraft, WW 134, was used for these trials, with the second prototype standing by at Boscombe Down as a reserve. Recent modifications to the aircraft pertinent to the deck trials were as follows:

Both wing and fuselage flaps, which are now of the plain split type, have extension pieces fitted giving an increase in total area, and the maximum available flap angle has been increased. The overall effect is a marked increase in available drag in the landing configuration. This has altered the characteristics of the drag curve, resulting in a lower minimum drag speed which, in turn, means an improvement in speed stability during the approach to land.

The wing flaps have super-circulation facilities, air from the engine compressors being tapped off at the final stage—normally used for combustion chamber cooling. This air is ducted to play over the top surface of the flaps via a full-span slot. Control of this is by the normal flap lever, the blow coming on after 5 degrees of wing flap extension, but a further switch is provided on the port console to cancel this facility when not required.

A steam-catapult launch from H.M.S. "Ark Royal" during recent acceptance trials. Note that a refuelling probe is installed in the nose.

Cdr. P. C. S. Chilton, R.N., the Commanding Officer of the Naval Test Squadron, flew the aircraft on board H.M.S. *Ark Royal* under conditions of marked ship movement, this being further aggravated by the sun reflecting on the deck-landing mirror. Only four catapult launches and deck landing were achieved during the remainder of that day and the following day, shared between the Commanding Officer and Mike Lithgow. The reason for the low total was bad weather and sea state.

Although too few deck landings were achieved to consolidate entirely the decisions reached during A.D.D.L.s, it was confirmed that the view cut off by the nose of the aircraft was not acceptable, as insufficient of the carrier deck could be seen to be certain of aligning the aircraft with the centre line. Modification to the aircraft is in hand to correct this defect and the next deck-landing trial will take place using aircraft with improved forward view.

Catapult launches at various weights were carried out. No undue difficulties in lining-up on the catapult were experienced. It was found necessary to apply the aircraft brake once the hold-back was attached to the aircraft prior to tensioning forward, as aircraft movement in sympathy with ship movement caused snatching of the hold-back itself which might have resulted in premature failure. On tensioning forward the aircraft rotated into the flying attitude until the tail-skid rested on the deck. The position was very comfortable, the launch itself was uneventful and no tendency to sink off the end was observed.

Although the trials were not as successful as they might have been, due firstly to shortage of available engine hours and secondly to weather, sufficient has been done to know that there are no major handling problems associated with flap blowing.

Further trials will be taking place this year at Boscombe Down on both prototype and production versions of this aircraft. Successful completion of these will ensure that the aircraft will be released to the Royal Navy before the end of the year.

Since this article was written another series of deck-landing trials has been successfully completed on board H.M.S. *Ark Royal*. The trials were carried out at operational weight, using the minimum catapulting speed, and were completed within the estimated time schedule.

BIG U.H.F. RADIO ORDER

AN order for airborne U.H.F. communications radios worth no less than $8.3m has been placed by the R.C.A.F. with Collins Radio Company of Canada, Ltd. The equipment involved is the AN/ARC-552, which is a direct Canadian adaptation of the American Collins AN/ARC-52. The R.C.A.F. is now undergoing a planned conversion from V.H.F. to U.H.F. for air-to-air and air-to-ground communications radio.

The ARC-552 and 52 offer a total of 1,750 channels over the frequency band between 225 Mc/s and 400 Mc/s. While all these are available to the pilot, nineteen of them are pre-set and can be selected for immediate use. An entirely separate guard channel is also available for emergency. ARC-52 and ARC-552 are completely interchangeable for installation purposes.

The new Collins equipment offers considerable advantages over its widely used predecessor, the AN/ARC-27. It has 20 per cent fewer valves; and its weight, at 51.5 lb, is 35 per cent lower. The volume has been reduced by 51 per cent. The ARC-552 is pressurized for operation at heights up to 70,000ft; printed circuitry and modular construction with standardized sub-assemblies are used; and all components are conservatively rated to increase their service life.

U.S. CIVIL CERTIFICATIONS

TYPE certification by the U.S. Civil Aeronautics Administration has recently been awarded to the Beechcraft Travel Air and the Piper Comanche. The former, a four-seat, twin-engined machine, first flew in August 1956; the Comanche, a single-engined four-seater, made its maiden flight in May 1956. Both aircraft are powered by 180 h.p. Lycomings.

B.S.I. ANNUAL REPORT

IN its annual report* the British Standards Institution refers in the aircraft section to standards either published or in preparation concerning metallic and non-metallic materials, components, electrical equipment and instruments. International work is also reported on, in particular the revision of B.S. M23 concerning aircraft identification markings, and a new standard (soon to be published) relating to aircraft connections for ground electrical supplies.

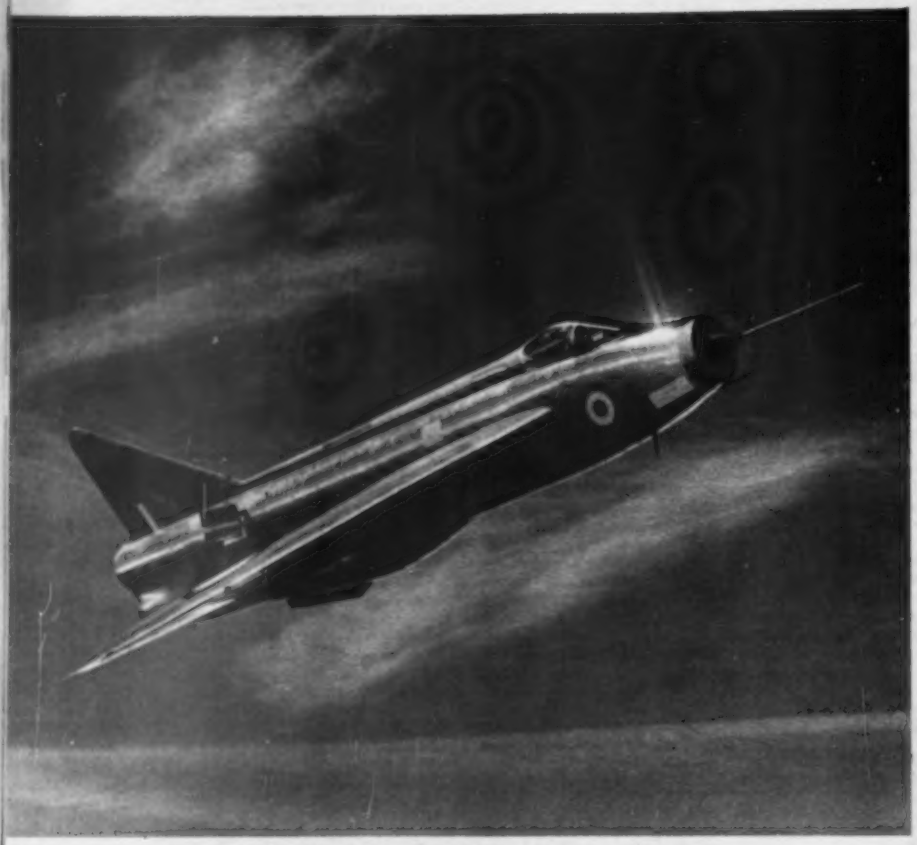
Both new and revised standards published between April 1, 1956, and March 31 this year are fully listed; and work in hand on new standards is catalogued in alphabetical order under categories.

**Published by the B.S.I. from British Standards House, 2 Park Street, London, W.1; price 7s 6d to non-members.*

AIR-TO-SEA PHOTOGRAPHY

IN contrast to the Scimitar pictures above, the fine photograph below, though again a nautical subject, is essentially unwarlike in character. The work of Skyfotos, of Lympne Airport, it shows m.v. *Valdes*, a cargo and passenger vessel of 2,196 tons gross, proceeding down Channel while one of Skyfotos' Auster Autocrats circles above. The Lympne company specialize in air-to-sea pictures of shipping, and nearly 150 examples of their work are currently on exhibition at the Ilford Gallery, 106-107 High Holborn, London.

Marine photography in the modern manner (see news-item above).



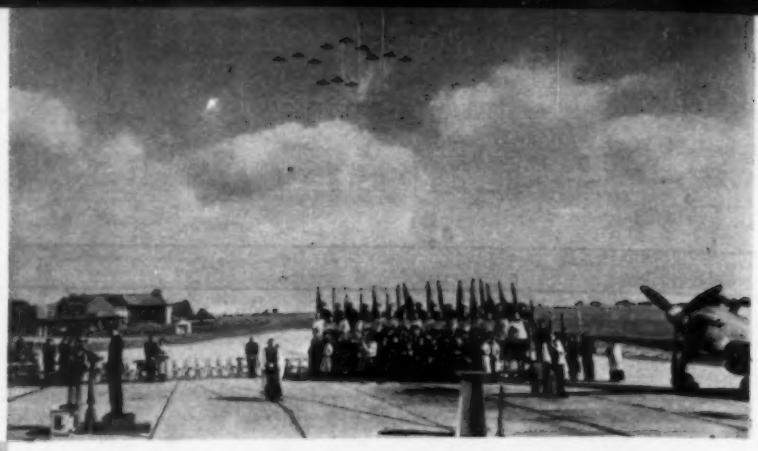
IN these "Flight" photographs the massive proportions of the English Electric P.1B combine with the superimposed reheat tailpipes of the twin Rolls-Royce Avons to convey an awesome impression of power and stamina. The ventral fairing—now finned—might eventually house a Napier Double Scorpion liquid-fuel rocket.

EPITOME OF POWE

POWER: THE ENGLISH ELECTRIC P.1B

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News



Battle of Britain Commemoration

WELL over a million visitors—Air Ministry gave the total as 1,079,880—went to the 37 R.A.F. stations open to the public last Saturday; and these "at homes," together with special services on Sunday, marked the climax of this year's Battle of Britain Week celebrations.

At **Biggin Hill**, of all wartime fighter stations perhaps the one most closely associated in the public mind with the Battle of Britain, the now-traditional flying display must rank as one of the finest in Europe; and this time a crowd officially estimated as 220,000 saw a show which was well up to standard. It was opened by Ray Milland, star of the new film *High Flight*, who arrived by Sycamore helicopter; and for three hours the airfield was as busy as London Airport, with aircraft of all types landing and taking off (in both directions) and the sky full of aircraft either aerobatting or flying past. There was also an elaborate and comprehensive static display of aircraft and equipment.

Throughout the afternoon aircraft which were "touring" other shows flew over Biggin—a Vulcan going past right in the middle of No. 111 Squadron's formation aerobatic display. A Valiant, a Victor, Meteor 8s, Meteor night fighters, Shackletons, Canberra T.4s, Sea Hawks, Javelins, a Viscount, B-45s, F-100Ds and F-86Ds all came and went. The Sycamore bowed and curtsied its way past the enclosures. A Chipmunk towed a Prefect glider to a vantage point and watched it pirouette its way silently down on to the airfield.

The old-timers were well represented. Though the wind was too strong for the Sopwith Pup, the Bristol Fighter, a silver Swordfish, Hawker's Tomtit (flown by Hugh Merewether), the last Hurricane (now stored at Biggin) and Jeffrey Quill's Spitfire all performed in a circus and individually, at one time accompanied by a Tiger Moth.

Two Chipmunks teamed up with two Cooper racing cars (one driven by A.V-M. D. C. T. Bennett) for a relay race round the field, but one car broke down, leaving the other an easy victory.

Three Chipmunks of the University of London Air Squadron gave a fine formation aerobatic display, despite rough conditions; and four Canberras, apparently B(I).6s, from No. 9 Sqn., went through a formation drill sequence while a fifth alternately aerobatted and showed his gaping bomb-bay.

S/L. Fifield ejected a dummy at high speed from a Meteor 7/8 at about 100ft.

Above, the new font for St. George's Chapel of Remembrance at Biggin Hill; and above left, Jeffrey Quill's Spitfire in action during last Saturday's flying display.

All worked perfectly and the dummy and seat appeared to be unscathed.

Individual aerobatics were presented by Vampire, by both piston and Jet Provost (the latter from Hullavington), Balliol, Meteor 7 and Hunter 5 of No. 41 Sqn. Particularly expert were the four-point roll of the Jet Provost, the prop-hanging climbing rolls of the Balliol, the smoothness of the Vampire evolutions and the rapid and precise manœuvring of the Meteor.

During the programme the C.A.S., Air Chief Marshal Sir Dermot Boyle, arrived in his own four-star Devon which then demonstrated a very low single-engined pass. A sergeant paratrooper from Abingdon made two delayed-opening jumps with a blank-gore parachute from a Tiger Moth. The first was perfectly judged, but during the second free fall he developed a spin and had to open early, being carried away from the airfield by the strong wind. An Anson simulated a forced landing and its crew were "captured" by "hostile natives." A Beverley then landed troops who liberated the men and captured the "natives," whose fort was then attacked and totally destroyed by seven Hunters and four Meteor night fighters. The attacks were rather cautiously delivered and some people missed the more precipitate ones made in past years by the Auxiliary squadrons' Meteors.

But the battle of the giants was that between the aerobatic teams of No. 111 Sqn. with their black Hunter 6s and the F-100Cs of the U.S.A.F. Skyblazers. This time there was no doubt that No. 111 Sqn. have achieved the lead. Even after giving two other shows (at Duxford and Horsham St. Faith) that afternoon, their loop and roll with nine aircraft, their constant formation changing and their smoke carried the day. The Skyblazers, too, now have very fine smoke and still do their individual-rolling Fleur-de-Lys manœuvre; but their extreme precision and afterburning spectacle do not match the Hunters' virtuosity. The leader came back for an individual show afterwards and frightened many children with a very low pass in a steep turn, blasting the enclosures with his afterburner.

Tangmere's programme opened with a bang so closely resembling the supersonic variety that many of the thousands of spectators present thought it really was one. In fact it marked the arrival of the U.S.A.F. Skyblazers and was produced by a synchronized application of re-heat. Their meticulous display of superb formation aerobatics was only equalled by a wide variety of individual performances by aircraft ranging from a Spitfire and Hurricane and a glider to a veritable swarm of Hunters, Javelins and Sea Hawks. Nearly all modern types of aircraft in use with the R.A.F. and Navy today were represented in a programme which was carried out with perfect pre-

At the end of Battle of Britain Week the new font, which incorporates the three swords of the station crest, was dedicated at a drumhead service at Biggin Hill (head of page) on Sunday; and the air display there on Saturday included a troop-laden short take-off by a Beverley (below).

Mk.5

The Martin-Baker Mk.5 Ejection Seat is now being delivered in quantity to the United States Navy.

MARTIN-BAKER

Aircraft Company Limited

England & Canada

'I should like to say a word about the future of the Royal Air Force . . . The introduction of new weapons will be a gradual process, extending over a good number of years, and even then there will still remain a very wide variety of roles for which manned aircraft will continue to be needed. I therefore hope that young men who have the ambition to be pilots, as well as those who are interested in new technical advances, will continue as before to look to the R.A.F. for a fine and useful career.'

MINISTER OF DEFENCE, APRIL 16TH 1957

Flying in the

THE NEED FOR PILOTS, navigators and air electronics officers is as urgent as ever . . . and the career prospects no less promising. Weapons change, tactics change, but the role of the Royal Air Force today remains the same.

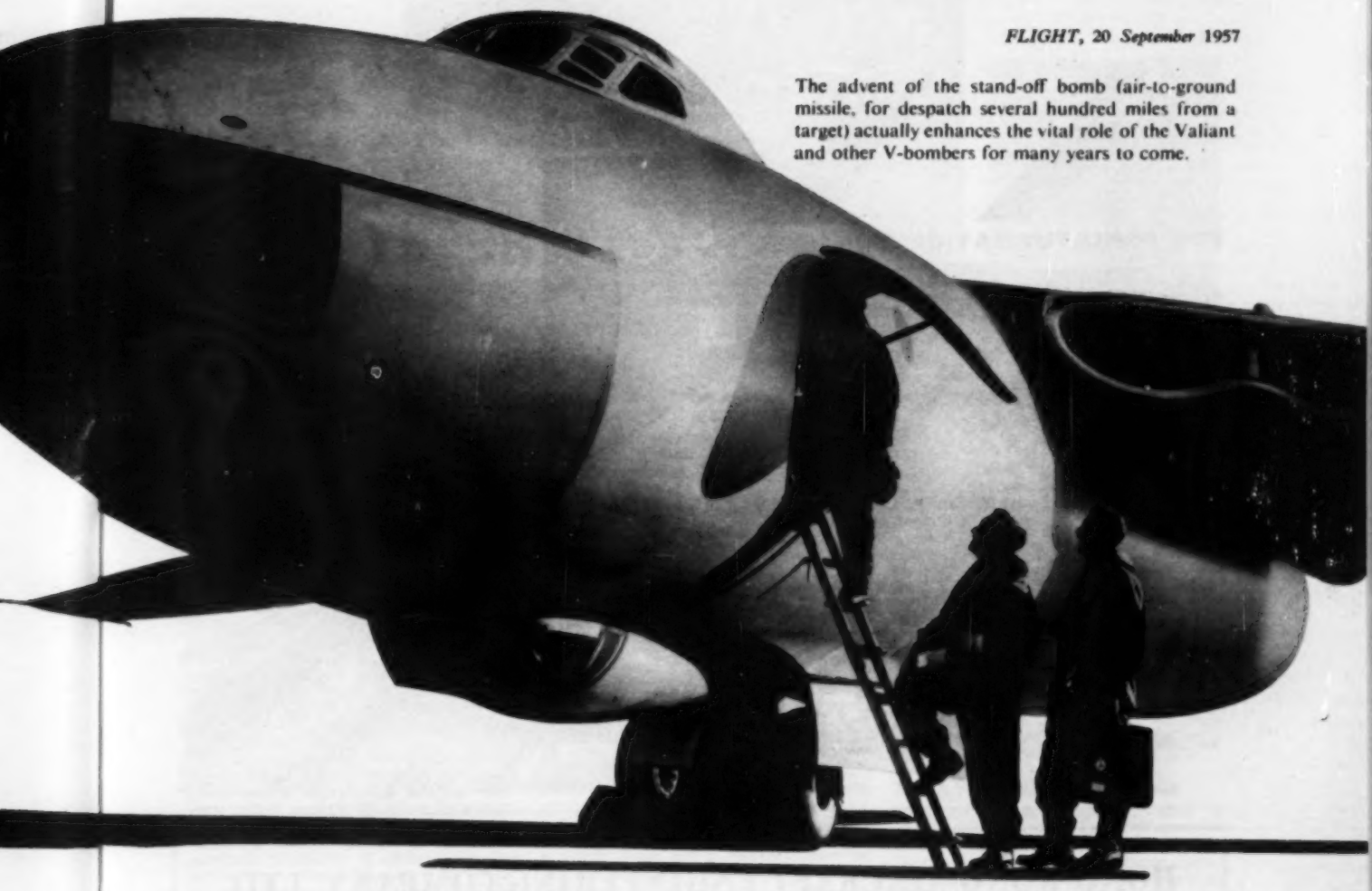
MORE OPPORTUNITIES—NOT LESS

To a young man ambitious to fly, and with the ability to lead others, the R.A.F. offers a fine and useful career. Men of high quality are required to fly the V-bombers, fighters and high-speed reconnaissance and transport aircraft. Even for those functions where unmanned missiles will in time give the answer, manned aircraft must continue in service for a number of years yet. Moreover, manned aircraft will *always* be needed for those functions to which the human brain in the air is indispensable. And, whatever new instruments of air power are evolved, the R.A.F. will always need men of initiative who have been trained to master the problems of the air in the air. For such men this is a time of opportunity. Not only can they fulfil their ambition to fly for as long as they serve. They will have the chance of a full and satisfying career. Aircrew do much more than fly. They are often seconded for other important work in Britain and abroad. Variety is more than ever the essence of a career in the R.A.F. Whatever a man becomes—pilot, navigator, air electronics officer—there is no limit to what he may achieve. Quality counts. There is, and always will be, room for good men.

A SURE FUTURE—GOOD PAY

You can join the R.A.F. through the Direct Commission Scheme, confident of a permanent career right up to pension age. Or you can choose a twelve-year engagement with the option of leaving after eight. If you leave after 12 years you take back to civilian life a tax-free gratuity of £4,000! Alternatively, there is a five-year Short Service Commission Scheme, and for University Graduates, a special four-year Short Service Commission. Whichever you choose, the pay is good. At the new rates, a

The advent of the stand-off bomb (air-to-ground missile, for despatch several hundred miles from a target) actually enhances the vital role of the Valiant and other V-bombers for many years to come.



e missile age

Flight Lieutenant of 25, can draw, with full allowances, about £1,500 a year.

HOW TO FLY WITH THE R.A.F.

You must be between 17½ and 25 and absolutely fit. You must have General Certificate of Education or Scottish Leaving Certificate or their equivalents. You must be able to lead others, and you must have aptitude as well as enthusiasm for flying. If you feel you have all these qualities, write at once for details of the schemes of entry and an informative booklet, to the Air Ministry (FR5), Adastral House, London, W.C.1. Give date of birth and educational qualifications.

RESPONSIBILITY. To fly with the R.A.F. is to work with the most dependable men in the world, confident and well qualified for each of the many calls on their skill and initiative.

ADVENTURE. R.A.F. personnel were aboard the *M.V. Theron* as she returned with the advance party from the Commonwealth Trans-Antarctic Expedition, on the 23rd March this year.

The Royal Air Force *Flying . . . and a career*

FOR MINIATURISATION CONSIDER
G.E.C. HEAVY ALLOY
● Mass balance in less space
● Increase the "Omega Factor"
● Save weight
G.E.C. tungsten alloy is made
in densities from 16·7 to 18·0 gms/cc.
THE GENERAL ELECTRIC CO. LTD., COMPONENT SALES DEPT., OSRAM METALS DIVISION, EAST LANE, WEMBLEY, MIDDX.

HONG KONG AIRCRAFT ENGINEERING COMPANY, LTD.

during the past year overhauled, repaired, modified or serviced the following aircraft and their engines

AIRCRAFT

CONSTELLATION 1049, CONSTELLATION 749, CANADAIR C-4, DC-7C, DC-6B, DC-6, DC-4, BOEING 307/STRATOLINER, DC-3, C-47, C-46/COMMANDO, CONVAIR 340, VISCOUNT 760, PBY5A/CATALINA, GRUMMAN MALLARD, BRISTOL 170, BEAUFIGHTER, F8F/BEARCAT, BEAVER, AERO 45, HARVARD, VAMPIRE, METEOR.

ENGINES

R985, R1340, R1820, R1830, R2000, R2800, R3350, ROLLS-ROYCE DART 510.

Enquiries to

HONG KONG AIRCRAFT ENGINEERING COMPANY, LTD.
Kai Tak Airport, Hong Kong *Tels.:* AIRENG

SERVICE AVIATION . . .

Air Chief Marshal Sir Claude Pelly, representing the Queen, leaving Westminster Abbey with his wife after the Battle of Britain service on September 15, left; and Mrs. Richard Gates, the first woman to fly from Hendon (in 1911), seen there at last Saturday's "at home" with the station commander, G/C. P. W. Stansfield.

cision and timing; and there was an instructive static display with competitions for both children and grown-ups.

Over 182,000 people attended the "at homes" at five Midland stations—**Castle Bromwich**, Birmingham, where 115,000 saw one of the finest flying shows ever staged there; **Gaydon**, Warwicks, the Valiant O.T.U. which (open for the first time) had 35,000 visitors; **Tern Hill**, Salop, home of No. 6 F.T.S., which attracted 15,000; **Cosford**, Salop, boy-entrant training unit, and **Little Rissington**, Glos., home of the Central Flying School, which had 9,000 and 8,000 visitors respectively. These attendance figures were all down on 1956 (Castle Bromwich by 35,000), doubtless owing to other local attractions and early inclement weather.

At Castle Bromwich, despite appearances by all three V-force bombers and many other famous aircraft, the Scorpion-Canberra which recently set up an (as yet unconfirmed) altitude record undoubtedly "stole the show," Tom Lampitt giving an excellent exhibition of flying. Another highlight was the aerobatic display by Lt. Terence Bourke in a Sea Hawk from No. 801 Sqn. at Brawdy, Pembs.

At Gaydon, where Air Chief Marshal Sir Harry Broadhurst, A.O.C-in-C. Bomber Command, and Air Marshal Sir John Whitby, Air Member for Personnel, were among the visitors, interest, of course, centred in the Valiants both aloft and on the ground, and in a Vulcan which landed and taxied past the crowds to the static show.

Tern Hill's spectators, as at Castle Bromwich, were deprived of the parachute jumping display owing to a high wind; but for three hours Hunters, Vampires and, notably, a Beverley, gave a display which thrilled everyone.

At Cosford, where attendance may have been somewhat affected by the influenza epidemic prevailing among the boy entrants (special precautions were taken to protect the public from infection), a three-hour flying display went off faultlessly. Little Rissington, whose principal R.A.F. guest was A.V-M. J. Cox, S.A.S.O. Flying Training Command, enjoyed formation aerobatics by the C.F.S. Provost team "The Sparrows," and exhibitions by a Jet Provost and Folland Gnat.

Church Fenton, home of Nos. 19 and 72 Squadrons, Fighter Command, was one of five Yorkshire R.A.F. stations "at home," and thousands of visitors saw impressive flying and static displays and enjoyed themselves at side-shows or joy-flying in Yorkshire Aeroplane Club Austers.

Highlights of the show were fly-pasts by a Comet 2 and a Beverley of Transport Command, and appearances by four U.S.A.F. Tornados and four Super Sabres. Demonstrations were given by a U.S.A.F. Sabre F-86D, a Sycamore of No. 275 Sqn., a Balliol, Marathon, Javelin 4 of No. 151 Sqn., a Beaver L-20, Varsity, Provost, Venom, Valiant B.1, and a Canberra 6. A Shackleton 2 of M.O.T.U., Canberras, and Meteor 14s of No. 72 Sqn. flew past, and Hunter 6s of No. 19 Sqn. gave polished displays of formation flying and stream take-offs and landings. There were impressive formation aerobatics by a team of four Meteor 8s from Manby.

Early during the flying display, which was opened by an aerobatic Meteor F.8, and in contrast to the scream and roar which was to follow, P/O. Jones, an instructor at the A.T.C. Gliding School at Rufforth, gave an excellent display of silent flight in a Slingsby Prefect sailplane before landing on the grass in front of the public enclosure.

About 10,000 people attended the Battle of Britain display at **Kinloss** in the north of Scotland. They saw formation aerobatics by Hunters from No. 43 Sqn. ("The Fighting Cocks"), Shackletons carrying out a supply drop, and a Valiant (flown by S/L. Barberry) and a Jaguar (driven by John Lawrence of the Ecurie Ecosse) depicting speed in the air and on the ground. There was also a military tattoo performed by members of all three Services.

THANKSGIVING SERVICE

In Westminster Abbey last Sunday the annual *Service of Thanksgiving for the Victory Achieved in the Battle of Britain in the Year Nineteen Hundred and Forty* was held, the Queen being represented by Air Chief Marshal Sir Claude B. R. Pelly, A.D.C.

When the congregation was seated, and the Dean and other church officers had taken their places, the R.A.F. ensign was ceremonially marched in slow time through the cathedral to be presented and laid on the high altar. It was a most impressive scene, only the slow step of the ensign party breaking the heavy silence; then like a burst of brilliant sunshine came the fanfare of trumpets, followed by the National Anthem.

The First Lesson included that most appropriate passage from Maccabees: "How shall we be able, being so few, to fight against so great a multitude and so strong . . . ? It is no hard matter for many to be shut up in the hands of a few. . . . Strength cometh from heaven."

As a text for his sermon, the Rev. M. S. Stancliffe, rector of St. Margaret's and canon of Westminster, took from Revelations 4 the passage, "I heard as it were a trumpet talking with me which said, Come up hither." He developed this thought on the lines first of men wanting and learning to fly (recalling that September 15 in fact marked the 173rd anniversary of the first flight in England by Lunardi, from London to Standon in Hertfordshire), then of the exhilaration and sense of freedom which all flying gives; and finally in its application to the everyday things of life.

After the Dean had given the blessing the congregation stood while trumpeters sounded the Call of the Royal Air Force, the Last Post and, finally, Reveille. Offerings were set apart for the R.A.F. Benevolent Fund.

At a march-past following the service, the salute was taken by Marshal of the R.A.F. Sir John Salmond, and a Spitfire and a Hurricane—followed after some minutes by a Javelin, representing today's R.A.F.—flew over the parade. So the latest proud annual commemoration of the Battle of Britain came to its ceremonial close.

R.A.A.F. Squadron Standards

THREE R.A.A.F. squadrons—No. 1 (Bomber) and Nos. 3 and 77 (Fighter)—received standards at ceremonies on September 12, during Air Force Commemoration Week. Air Marshal the Earl of Bandon, C-in-C. F.E.A.F., made the presentation to No. 1 Sqn. (formed in 1916) at Tengah on Singapore Island; and at Williamstown, N.S.W., Air Marshal Sir Richard Williams, a former C.A.S. of the R.A.A.F., presented standards to No. 3 (also formed in 1916) and No. 77, which was not formed until the Second World War but received the award for its outstanding service.

No. 264 Sqn. Reunion

A REUNION of past and present officers of No. 264 Sqn. is to be held at the officers' mess, R.A.F. Middleton St. George, near Darlington, Co. Durham, on Friday, October 25. Those interested are asked to write to the Adjutant, No. 264 Sqn., at the above address as soon as possible.

IN BRIEF

R.A.F. aircraft are this weekend taking part with those of the French, Belgian and Dutch Air Forces in SHAPE's annual directed training exercise, Operation "Counter Punch."

* * * * *

Kirkham R.A.F. Station, near Preston, Lancs, opened in 1940 and now occupied by No. 10 Technical Training School, is to be closed in March next year.

* * * * *

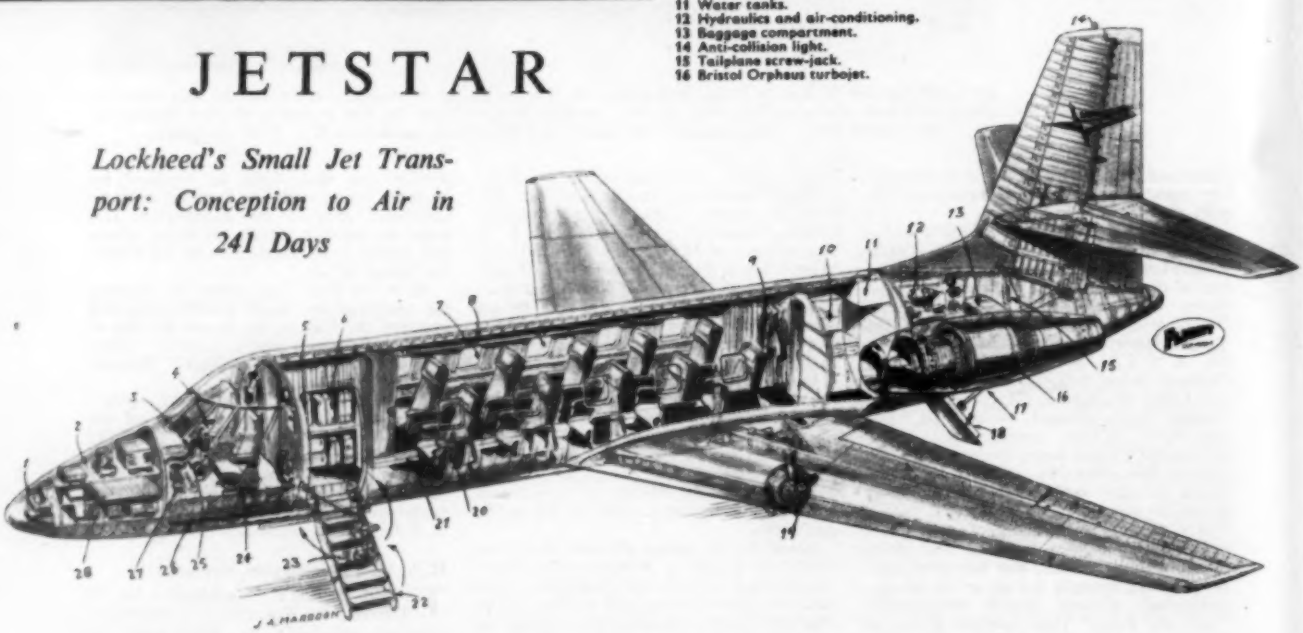
The R.A.F. Golfing Society Championship was won last week on the Berkshire Golf Club course at Ascot by Maj. V. Kregal, an American. In the 18-hole final he beat W/C. M. Blake by 3 and 1.

The Orpheus-powered CL-329 Jetstar in the erection shop.

1 Aerial compartment.
2 Radio and other electronics.
3 Hooded instrument panel.
4 O.V. panel operable by one hand.
5 Plug-type door.
6 Baggage to starboard.
7 Punkah louvre.
8 Reading light.
9 Coat stowage.
10 Fully equipped washroom.
11 Water tanks.
12 Hydraulics and air-conditioning.
13 Baggage compartment.
14 Anti-collision light.
15 Tailplane screw-jack.
16 Bristol Orpheus turbojet.
17 Access to aft equipment and baggage.
18 Dive flap for rapid let-down.
19 Hydraulic or gravity-fall main gear.
20 Oxygen unit at each seat.
21 20in recessed aisle to increase headroom.
22 Folding stairway.
23 Forward-retracting nose gear.
24 Adjustable seats and armrests.
25 Forward-mounted control column.
26 Flush strip aerial.
27 Adjustable rudder pedals.
28 Two large electronic doors.

JETSTAR

Lockheed's Small Jet Transport: Conception to Air in 241 Days



AT the beginning of the year the Lockheed Aircraft Corporation made a surprise announcement: a small jet transport was being planned to meet the requirements of the U.S. Air Force UC/X specification, and a prototype would fly on September 4. Actually Mr. C. L. ("Kelly") Johnson, vice-president for special projects, timed the first flight for 9 a.m. on that day—all this before metal had been cut.

When the moment came his prediction was fulfilled: the aircraft had then already been in the air for two minutes. From the basic three-view layout stage it had taken just 241 days to get the Jetstar airborne. The first flight, at Edwards A.F.B., lasted 39 min, and is described as "smooth as silk."

We introduced readers to this aircraft in *Flight* for July 12 last, in which appeared an analysis of the numerous small jet transports which are being planned for the executive market and for the two U.S.A.F. specifications. The latter are UC/X, a four-engine configuration for transport, crew-readiness training and similar functions, and UT/X, the corresponding small twin, primarily for training. Lockheed are first off the mark, with Model CL-329, now named the Jetstar, designed to meet the four-engine requirement.

Largely owing to the unavailability of the little General Electric J85 or Fairchild J83, both turbojets in the 2,000 to 2,500 lb class, the first Jetstar has been fitted with British engines—twin Bristol Orpheus. These, with a rating in the 4,230-5,000 lb bracket, performed on the first flight to such an effect that the pilot, Ray Gudey, had to reduce power at take-off to avoid overshooting the "chase plane."

Lockheed have designed and built the Jetstar at Burbank, but it is now the responsibility of the Georgia Division, at Marietta. This division recently described the aircraft as "ideal for transition pilot training, heavy bomber crew training, testing ground navigational aids . . . high-speed navigation training and gunnery practice, inflight-refuelling indoctrination and high-priority cargo carrying . . ." The *Flight* copyright drawing above shows most of the principal design features.

Lockheed CL-329 Jetstar: Two Bristol Orpheus, later to be four Fairchild J83 or G.E. J85. Span, 53ft; length, 58ft; overall height on ground, 21ft; wing sweep, 34 deg; gross wing area, 523 sq ft; cruising speed, 500 to 550 m.p.h. at 25,000 to 45,000ft for stages up to 2,000 statute miles. No weight data yet available.

A SATISFYING FLYING FILM

IT must be difficult for film makers to find a scenario with so-called "human interest" which is worthy of the air-to-air sequences in a fine picture such as *High Flight* (now at the Empire Theatre, Leicester Square, London). These sequences were referred to in *Flight* of September 6, and we have now been able to see the whole film. Directed by John Gilling in CinemaScope and Technicolor, this Warwick production is one of the most satisfying films of its kind—not excluding *Twelve o'Clock High*, *The Threshold of Space* or *The Spirit of St. Louis*. Extensive shots of R.A.F. aerobatic team Hunters practising for the Farnborough Display, a damaged Hunter being escorted back to base, and a dawn take-off—all these are of a grace and beauty which leaves nothing to be desired. The film's human story, concerning a tiresome "mixed-up" young cadet at Cranwell and his friends, all of whom graduate to membership of the aerobatic team, is not so sublime. Perhaps only a theme adapted from Homer or the Norse Sagas could live up to the perfect self-sufficiency of the flying, though scenes of Cranwell life are interesting.

Performances are adequate in most cases, and one or two better than adequate—namely those of Ray Milland as an exacting wing commander with a heart of gold, Bernard Lee as a tough flight sergeant, and Anthony Newley as an egg-head cadet with a penchant for flying saucers. The greatest credit must be given to the Royal Air Force for their whole-hearted co-operation throughout the film.

KINGSFORD SMITH MEMORIAL

AS a memorial to the late Sir Charles Kingsford Smith, the Fokker F.VII which he captained in 1928 on the first flight from America to Australia is to be housed permanently at Eagle Farm, Brisbane, Queensland, where he landed. This memorial is to be opened officially on June 9 next year, the 30th anniversary of the flight.

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Show Shortcomings?

SPLENDID though this year's S.B.A.C. Farnborough Show undoubtedly was, I think there is room for improvement in four respects. These may be summarized as follows:—

(1) The exclusion of British aircraft powered by American engines must not be allowed to continue. The primary object of the show is to boost the sales of the aircraft industry and the rules governing eligibility for display should be reviewed in this light. Sales of the aircraft in question would undoubtedly benefit and the appearance of the American engines would be detrimental to nobody's sales drive, as there are no comparable British engines. On the other hand, the Canadian aircraft and engines that have appeared represent a severe threat to certain British products and should, in my view, be excluded.

(2) If the Show is to continue to be of commercial importance, particularly where military aircraft are concerned, the ban on supersonic flying must be lifted. Let officialdom ponder how long foreign representatives will consider it worth coming to see the aircraft in which they are interested performing at less than half speed. It is up to the S.B.A.C. to make the first move and give the Minister of Supply a guarantee that they will meet all claims for damages.

(3) An invitation should be extended to Britain's glider manufacturers to participate in the flying programme. Sailplanes are a prospering export line and recognition of the fact at Farnborough would be well deserved. Their participation would also enhance the flying display, not only because of the inherent beauty of sailplane aerobatics, but also by virtue of the contrast it would give the show.

(4) More should be done to demonstrate the operational capabilities of the aircraft. If ground-attack demonstrations are impractical, an area should at least be cleared for heavy-load parachute drops; and a strike aircraft manœuvring as for a LABS bomb-lobbing mission would be worth watching.

Surbiton, Surrey. A. J. TENEBURY.

The First Inverted Loop

I GREATLY appreciate Mr. Austin's nice remarks (Correspondence, August 30). The aircraft which was looped inverted was, however, the D.H. Moth which Hubert Broad used to lend me from the de Havilland stable. I still think it was the first to loop from inverted flight back to inverted flight. "Bunted" loops had been done before, and indeed (I think) before General Doolittle did them.

I have an old (and probably erroneous) account of Pégoud doing one in the pre-aerobatic days of flying.

London, W.1. PATRICK JOHNSON.

Stratocruisers—a Final Postscript

I AM gratified to see that my article on the Boeing B-377s (June 14 issue) appears to have evoked general interest amongst your readers. I should particularly like to thank Mr. Robert L. Armstrong for his interesting letter (August 16 issue) and Mr. Gordon M. Bain (vice-president, Northwest Airlines), Mr. Fred Tupper (public relations manager, P.A.A., London) and Mr. F. C. Gillman (chief Press officer, B.O.A.C.), all of whom were kind enough to write to me.

The following additional miscellaneous data on the Stratocruisers will, I hope, be of interest.

B.O.A.C.'s R.M.A. *Canopus* is probably the most distinguished aircraft of this type in the Corporation's fleet of 16. This is because on several occasions in the past few years she has carried leading members of the British Royal Family on some of their Commonwealth tours: in addition she has also carried many other distinguished V.I.P.s, including Sir Winston Churchill, Sir Anthony Eden, and Earl Attlee on flights to and from the U.S.A., Canada, and Bermuda. In addition, both P.A.A.'s and Northwest's B-377s have carried countless numbers of V.I.P.s.

Intense competition in the airline business makes it significant to record that P.A.A. found it essential to replace DC-4s with B-377s on their U.S.A./Australia schedules early in 1951 because they were losing so much business to B.C.P.A.'s DC-6s on the same route in those days. Currently P.A.A. is using both B-377s and DC-6Bs on this same route in direct competition with Qantas Super-Connies: both carriers operate four weekly flights in each direction.

An idea of how much current utilization P.A.A.'s Pacific Division are getting out of a maximum of nine aircraft of this type can be gauged as follows. In a typical 30-day period, one B-377 will do three round trips U.S.A./Manila, two U.S.A./Honolulu/U.S.A., and one U.S.A/Australia round trip plus an additional San Francisco/Sydney flight. Despite the recent introduction of P.A.A.'s DC-7Cs on the Pacific run to Japan/Manila, the continued firm popularity of the Boeings with passengers remains virtually unchanged, as traffic figures have proved—even since the faster and longer-range "Seven Seas" went on this route.

Mr. Armstrong makes a most intriguing point when he states that a grand total of 56 civil B-377s were built, *including* the original civil prototype NX 90700 which, according to my own records, was not acquired by P.A.A. until some time in 1954, when it became N.1022V *Clipper Nightingale*. According to Harold Mansfield's superb book covering the 40 years' history of Boeing (*Vision—a Saga of the Sky*), the total number of commercial B-377s built was 55. It would be extremely difficult to find any mistakes in this excellent book. Nevertheless, there is probably an explanation (unknown to me) covered in Mr. Armstrong's own records on the Stratocruisers.

Regarding B-377 test-flying, A. Elliott Merrill (who is now Boeing's military sales manager) can claim a unique test-pilot's "record." As the company's senior test pilot in 1945 he (and co-pilot John Fornasero) flew the first XC-97 military prototype (Serial 43-27470) on its record-breaking Seattle/Washington non-stop flight on November 9, 1944. Exactly twelve years later Merrill piloted the 888th (and last) C-97 built—actually a KC-135 aerial tanker Serial 33816—on its first flight. Both Merrill and Fornasero flight-tested large numbers of both military and civil B-377s in the years between, although, of course, Boeings have always employed about twelve test pilots at their huge Seattle and Renton plants.

An idea of the tremendous development and initial production costs which had to come out of Boeings' own financial resources on the civil B-377s built can be gauged from the fact that in the year 1947 the company had to write-off about $7 million! Even to make a *modest profit* they had to sell a minimum of 50 Stratocruisers in order to get the price per unit down to $1½ million so that the first customer, P.A.A., would finally agree to buy. However, this enormous expenditure eventually paid off rich dividends to Boeing, as undoubtedly the company's reputation with operators of the Stratocruiser has made its own important contribution to established experience of doing big business with major airlines: hence just one reason for the enormous success of 707 commercial sales to date.

Nairobi, East Africa. DENNIS M. POWELL.

An R.F.C. Again?

AFTER 40 years without a "private" air force, Britain's Army is to have an Air Corps—an amalgam of the Glider Pilot Regiment, the Royal Artillery element of the A.O.P. Flights, and its helicopter interests.

Therefore, why not revive the title Royal Flying Corps, that is, if the present guardian of the heritage, the R.A.F., does not object? The A.A.C. will be carrying on the work of a corps which was in effect a "private" air force of the pre-1918 Army.

London, N.W.2. L. F. E. COOMBS.

Underneath the Arches

ON reading *Ninety Nine Lives*, the story of Charles Veil, by Howard Marsh, I find that on November 17, 1918, Charles Veil flew a Spad fighter through the Arc de Triomphe, much to the consternation of the Parisians and Allied top brass.

This set me thinking. I looked up *Alert in the West*, by Willi Heilmann who, inspired by five Lockheed Lightnings sitting on his tail, flew his Fw.190 under a high-tension wire, skimmed the Seine and went straight through the right span of a bridge. I also recall the tragic fate of a Vampire pilot who flew under the Clifton suspension bridge and the flap when a retired major flew a light plane under one or more of London's famous bridges spanning the Thames.

Does any reader know of similar instances?

Birmingham 14. MAURICE AUSTIN.

FORTHCOMING EVENTS

Sept. 16-20. Institute of Metals: 49th Annual Autumn Meeting.
Sept. 19-22. Austrian Aero Club: Innsbruck and Salzburg International Air Rally, Innsbruck.
Sept. 21. R.N.A.S. Abbotsinch, Paisley: At Home.
Sept. 21. Plymouth Aero Club: Cocktail Party and Dance.
Sept. 21-22. Cranfield Society: A.G.M. and Dinner, Cranfield.
Sept. 22. London Gliding Club: Sailplane Aerobatic Contest, Dunstable.
Sept. 24-26. Royal Radar Establishment: International Symposium on Electronic Components, R.R.E., Malvern.
Sept. 28. British Interplanetary Society: "Geophysical Research with Artificial Earth Satellites," by Prof. S. F. Singer.
Oct. 16. G.A.P.A.N.: Annual general meeting.

THE INDUSTRY

This Anson 19, owned by Lec Refrigeration, Ltd., and piloted by Mr. George Farley, operates from a private airfield adjoining the company's premises at Bognor Regis and is kept busy as an executive aircraft and flying showroom. In mid-October it is going to the Rhodesias and possibly South Africa, landing in Egypt en route; and a flight to Canada (with long-range tanks installed) is planned for early next year. A typical "load" is the pilot and sales director, plus three refrigerators; and the Anson can take three passengers in addition.

Radar-absorbent Materials

THE Plessey Group of companies has developed a range of materials which absorb radar pulses instead of reflecting them. Though there would appear to be obvious attractions in this type of material for tactical counter-measures application, at the moment it is considered mainly as a laboratory tool. It could be readily applied to objects on and near airfields to make them non-reflective to surveillance radar and thus to eliminate sources of troublesome permanent echo.

One of the materials consists of foam-rubber panels with a cellular profile in which a radar beam is absorbed so that no energy remains to be reflected back. Radar pulses over a wide band of frequencies can be absorbed in this way. Another material is made up of rubber sheets bonded to brass gauze or sheet. In this case the pulses are blotted out by interference, i.e., reflections from the front and back surfaces cancel each other out. This material can deal only with a narrow band of frequencies, although different gauges of sheeting could be used to provide coverage of other bands.

New Silicone Products Factory

RECENTLY completed plant for Texas Instruments, Ltd.—first British subsidiary of Texas Instruments, Inc.—is due to be opened on a site in Dallas Road, Bedford, on October 1 and thereafter the company will be engaged in the manufacture and marketing of silicon semiconductor products. Its parent concern is said to have pioneered the art of growing crystals for such products, and to be now the largest commercial manufacturer of germanium and silicon transistors (whether output is measured in units or dollars) in the world; the subsidiary is concentrating initially on the production of silicon rectifiers and transistors which can be used in conditions where heat precludes the use of germanium types.

Mr. Dudley Saward.

The managing director of Texas Instruments, Ltd., is Mr. Dudley Saward, an ex-R.A.F. officer who during the war became chief radar officer to the A.O.C-in-C. Bomber Command, Air Chief Marshal (now Marshal of the R.A.F.) Sir Arthur Harris. Mr. Saward was appointed O.B.E. for his services in connection with the development and application of radar navigational and blind-bombing devices. After leaving the R.A.F., he served with B.E.A. until 1948, and helped to establish International Aeradio.

Canadian Instrument Specialists

CURRENTLY developing telemetering apparatus for missiles and high-speed aircraft, Phoenix Engineered Products, Ltd., of Toronto, have a varied background in the field of aircraft instruments. Over 3,000 instruments per month now pass through the company's North Toronto plant.

The forerunner of the company was formed in Toronto during the early months of World War 2, when production of altimeters, A.S.I.s, manifold-pressure gauges, rate-of-climb indicators, fuel and oil-pressure gauges and boost gauges was begun to meet the critical shortage of these instruments in Canada. The company was the first in Canada devoted exclusively to the manufacture of aircraft instruments. Simultaneously, the production of electrically-driven fuel booster pumps was under way.

In 1945 wartime contracts were cancelled and 1,200 skilled personnel were diverted to peacetime production. A nucleus of instrument designers remained, and Phoenix Engineered Products was forced to manufacture precision control devices and special tools. Overhaul and modification of precision instruments, including bombsights and gunsights, for the Canadian Services was recommenced in 1947. Five years later the company moved to a new 73,000 sq ft plant in North Toronto.

Through the years the company has acquired physicists and engineers who are thoroughly competent to deal with electronics as applied to recent technology in weapons and aircraft. Phoenix products have attained a reputation for accuracy and reliability, a recent example being the selection of the company's precision transducer equipment for a most critical application after, it is stated, detailed comparative tests had been made of products from reputable organizations throughout the world.

The Phoenix company also distribute a wide range of aircraft products, including Williamson aerial cameras and multiplex equipment, Old Delft scanning stereoscopes, Jackson stereoscopic projectors, Self Priming Pump and Engineering fuel booster pumps, and Avimo fittings. The Hon. James D. McCurdy, the first man to fly an aircraft in Canada, is one of the directors of the company.

Irving Air Chute Post

AT present at the Imperial Defence College, A. Cdre. C. L. Dann, C.B.E., B.Sc., F.R.Ae.S., has been appointed director of the research and development department of Irving Air Chute of Great Britain, Ltd.

He was previously A.O.C. and Commandant of the R.A.F. Technical College, Henlow (1954-56); Director of Technical Services (Air), B.J.S.M., Washington (1951-54); Chief Superintendent, Rocket Propulsion Department, Westcott (1948-51); and Deputy Director, Operational Requirements (2), at Air Ministry (1946-48).

IN BRIEF

Mr. G. F. Laurence has been appointed personal assistant to Mr. M. Goldsmith, chairman and managing director of Metalastik, Ltd. He was formerly director and general manager of Brookes (Oldbury), Ltd.

* * *

A catalogue is now available of KnitMesh products—applications of which include air-intake elements, demister installations and shielding gaskets—manufactured by the Knitted Mesh Manufacturing Co., 36 Victoria Street, London, S.W.1.

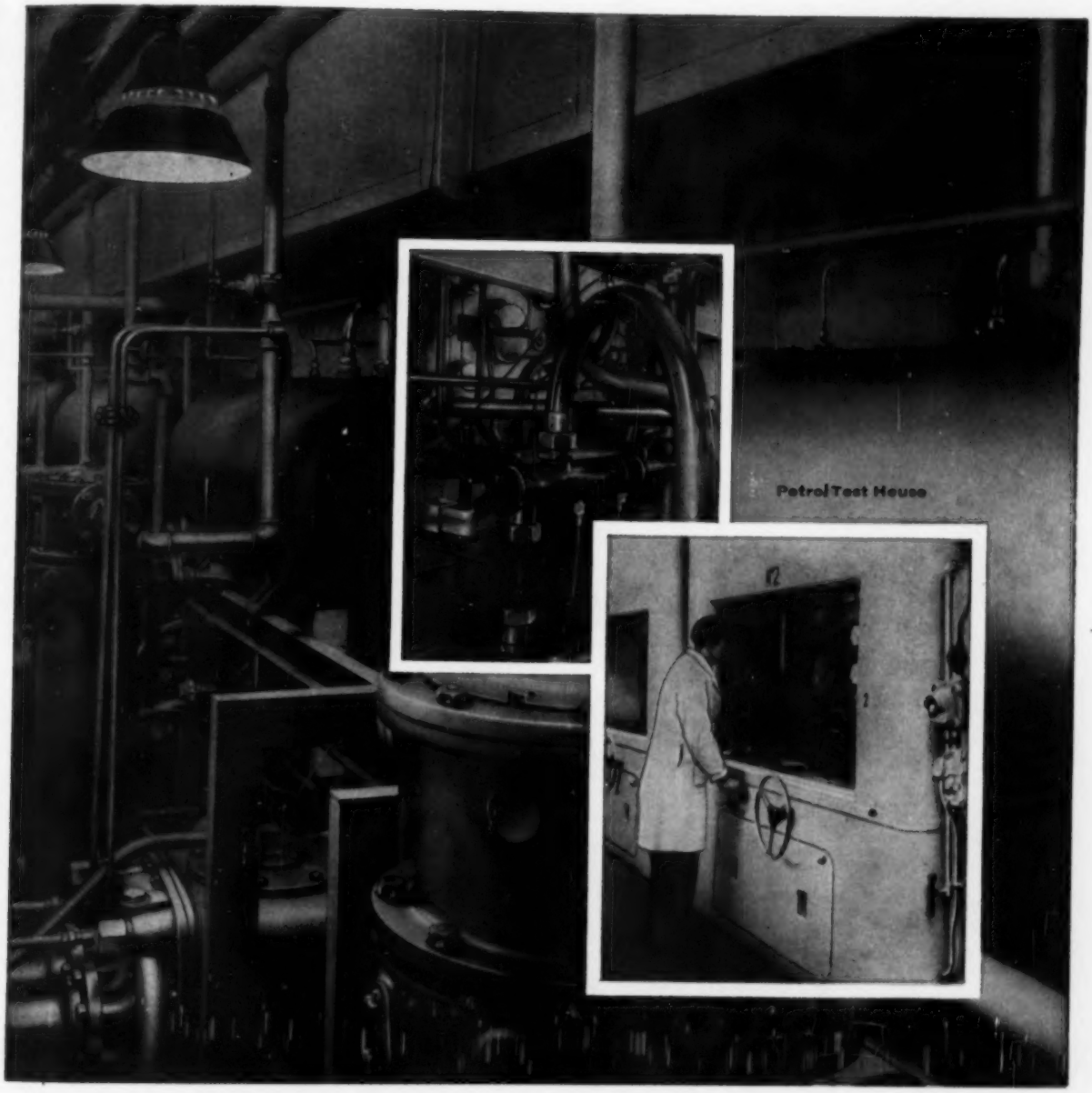
* * *

Two new products of H.M.L. Engineering, Ltd.—a universal pump test-rig (designed to test hydraulic pumps with input torques up to 148 lb/ft from 0-2,500 r.p.m. and 148-67 lb/ft from 2,500-5,500 r.p.m.), and a universal tyre remover—are described in illustrated leaflets published from the company's offices at 466-490 Edgware Road, London, W.2.

* * *

W. S. Electronics (Production), Ltd., announce orders from the Royal Navy and the R.A.F. for their U.H.F. transmitter/receiver Type D.103, developed by W. S. Electronics as a proprietary equipment. They further announce the appointment of Col. A. E. Tyler, O.B.E., as general manager of both W. S. Electronics (Production), Ltd., and W. S. Electronics (Extruder), Ltd.; and that Messrs. G. C. Wheeler and J. Wolff have resigned from their directorships of these companies.

Lt-Cdr. John C. Winterburgh, R.N. (Ret.), appointed assistant to Mr. John H. Davis, European sales representative in London for Canadair, Ltd. Lt-Cdr. Winterburgh, an electronics specialist and an accomplished linguist, served during the war in the R.N. electrical engineering branch. He recently paid a familiarization visit to the Canadair factory in Montreal.



Test Rigs for world wide serviceability of gas turbine fuel systems

In 1940, no available test rigs were sufficiently accurate for our fuel systems; since then a wide range has been designed and produced by us. Today, with our vast comprehensive technical resources, supported by immeasurable experience in this field, we can design and produce any specialized test rig you require.

- *Robust and compact in construction.*
- *High degree of accuracy.*
- *Filters fitted to all rigs.*
- *Tailored to characteristics of fuel system units.*
- *Ease of operation.*
- *Readily accessible for easy maintenance.*
- *Provision for automatic endurance cycling.*
- *Requirements of basic hydraulic tests met in design and manufacture . . . and ancillary electrics included.*

LUCAS

Fuel and Combustion systems for Gas Turbine Engines

JOSEPH LUCAS (GAS TURBINE EQUIPMENT) LTD., BIRMINGHAM & BURNLEY, ENGLAND
LUCAS-ROTAX LTD., TORONTO, MONTREAL & VANCOUVER, CANADA
LUCAS-ROTAX (AUSTRALIA) PTY. LTD., MELBOURNE & SYDNEY, AUSTRALIA

This summer—
fly in Europe's newest airliner...

PARIS
BRUSSELS
AMSTERDAM
COPENHAGEN
GENEVA
ZURICH
DUSSELDORF

BEA VISCOUNT 800 now serving 12 routes

You're favoured if you fly from London to any of the places on this list. Why? Because you can make the trip in a BEA Viscount 800. And that's something to look forward to.

No journey ever went so quickly, so smoothly, so pleasantly before. Two or three hours of air-conditioned comfort—time enough to enjoy a smoke, a duty-free drink, a delicious meal—and you're there, without a care on your mind, or a wrinkle in your suit!

FRANKFURT
DUBLIN
BELFAST
GLASGOW
NICE

With the Viscount 700 serving 30 destinations in Europe, you can now fly BEA Viscount to 42 destinations. Full details from your travel agent, any BEA office, or BEA, Dorland House, Lower Regent Street, London S.W.1. (Tel: GERrard 9833).

BEA **VISCOUNTS FLY ALL OVER EUROPE**

BUILT BY VICKERS | POWERED BY ROLLS-ROYCE

BRITISH EUROPEAN AIRWAYS

The Plesman Memorial Lecture

THE second Dr. Albert Plesman Memorial Lecture was due to be given last Wednesday, September 18, at the Technological University, Delft, by Mr. A. E. Raymond, Vice-President Engineering, Douglas Aircraft Company, Inc., who is portrayed on the right. A selection of salient quotations from his lecture—which was entitled "The Oceans of the Air"—is given here.

"WE have heard many people refer," said Mr. Raymond, "to the shrinking world of air transport, but to my mind no one has expressed with such inspiration the duality of technical and social advance offered by our industry as has been done by Plesman in his phrase 'The oceans of the air shall unite all people.'

"I shall attempt this afternoon to explore the potential of this ideal as it may appear during the next ten years, 1957 to 1967. In this effort, I will survey the fundamentals of passenger and cargo development; the types of vessels which will sail; and the development of route structures over these oceans of the air.

"We have seen the passenger reaction to the efforts of de Havilland and Vickers, and Fokker and Sud Aviation, with the first echelon of turbine-powered transports. Even though these types have not offered the passenger the full speed capabilities of jet transport, the lack of vibration and noise has introduced a radically new standard of passenger comfort.

"The development of a traffic forecast . . . involves a careful study of past records and present levels which are then extended to any future period by the influence of growth of gross national product, personal disposable income and population.

"In presenting our own traffic forecast [see below] I am able to offer . . . what turns out to be, I am happy to say, a middle of the road projection of future demands.

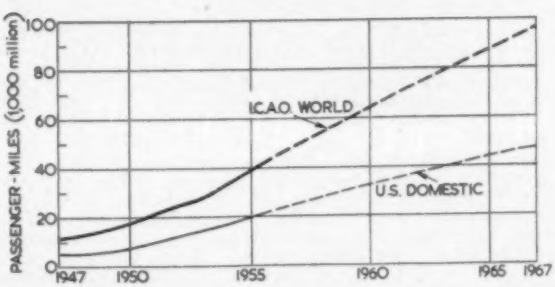
"About ten years ago the air cargo business was cursed by an excess of optimistic prediction. The natural result of a performance which barely reached four per cent of the forecast was a plunge into pessimism. . . . However, the growth of air cargo has been continuous at an average rate of some 25 per cent anually, which is greater than the growth of passenger traffic. In recent months there has been evident a renewed excitement. The message of economy . . . is beginning to find a receptive audience.

"*Emergency* cargo shipments are today's prime market. . . . We have been told by one of the largest U.S. cargo airlines that over 70 per cent of its shipments are of emergency nature.

"In analysing air freight . . . the true values become apparent when the movement of goods is considered in the overall sense. This includes not only transportation costs, but also the costs of warehousing, packaging, financing, inventory control, damage, pilferage and obsolescence. When all these expenses are considered in aggregate, substantial savings are apparent on many articles even at today's rates.

"If air cargo tariffs were to continue at today's level, a forecast of growth based on gross national product indicates an increase of 140 per cent by 1967.

"Recently we have developed a turboprop revision of the DC-7C called the DC-7D cargo plane, which will reduce today's direct



The Douglas forecast of air transport growth. In preparing it (said Mr. Raymond) Douglas made no allowance for (1) increased "acceptance" of air travel, (2) expansions in industrial economy which may follow social developments such as O.E.E.C. and nuclear power, (3) variations from present fare-levels.

operating cost by a third. . . . We must think in terms of 11,000 million cargo ton-miles [in 1967] on a world basis.

"At this time, though we have the technical know-how, the short range and high operating cost associated with supersonic operations would be untenable for the airline world, and we think such aircraft will depend on developments in powerplants and fuels unlikely to be available until the 1970-1980 period. Therefore, we envisage the coming decade as a period of economic and technical consolidation, in which the advantages normally associated only with trunk line equipment may be made available to the other elements of airline service.

"Past history in such a dynamic [aircraft manufacturing] industry is of less meaning than present performance. No manufacturer has a right to think—or to say—that he will be among the favoured few. The jet race offers great success to the few and disappointment to many—no one can foretell the outcome.

". . . We may expect technical advances and improvements in any and all of the engines associated with these DC-8 aircraft. If history is indicative of the future, we know that increases in power will be used for economic benefit by provisions for greater payload; and as fuel economy is improved we can look forward toward longer ranges at full payload.

". . . I think we may conceive that passengers become accustomed to the benefits of jet travel on long distance, high density operations will demand similar facilities in areas of operation which, for some years, will be unable economically to support aircraft as large in payload as the DC-8 type.

"In both the U.S.A. and abroad, turbine engine development has flowered under the combined influence of military development and civil acceptance, permitting both turboprop and pure jet designs with airplane efficiencies similar to those of the DC-8 class.

"The methods by which airframe and powerplant maintenance costs are calculated may be less than accurate compared to the eventual operational truths. . . . The same type of thing holds for the relative evaluation of different breeds of aircraft—piston, turboprop and jet.

"What about the first cost? . . . On the basis of seat-miles per hour, the value of the DC-8 is 34 units per dollar compared to 22 units per dollar for the DC-7C. The improving technology of design seems to be offering, as it should, mutual benefits to the manufacturer, the operator and the passenger.

"This leads into another prime topic of cost considerations—namely, cost per passenger-mile versus cost per airplane-mile. There are good arguments that each of these is of more importance, and of course, nothing could be better than to have an airplane which excels in both at once. However, in a competitive situation, an operator with a low cost per mile airplane who attracts few passengers could well fail in his enterprise; and conversely, the one who has a high load factor should be most interested in his costs per passenger-mile. These conclusions, of course, are based on the existing fare structure, which varies with *degree of service*, but not with the *type of aircraft*.

"No matter how carefully the manufacturer labours over the design, fabrication, and testing of a new model, or how meticulously the operator trains his mechanics and crews and surveys his route and airport considerations, some degree of expense and trouble must be expected before an airplane is shaken down and able to achieve the standards of reliability and utility required for profitable operation.

"It appears that the trickle down to non-I.C.A.O. operators will [by 1967] absorb all of the existing piston-engined transport capacity—and perhaps even more.

"I find myself, somewhat unhappily, in the middle of the jet *versus* turboprop controversy which has been carefully studied and reported on by a number of capable and reliable aeronautical experts. I obviously cannot expect to be right if I choose either side because various experts have proven, at least to their own satisfaction, that the jet excels in all fields—and with equal sincerity, that the turboprop excels in all fields.

"I am not trying to straddle the fence when I offer the opinion that each of these types excels in defined areas, with defined operational requirements, and with a defined state of the art.

"In our present state of the art the jet can exceed the turboprop in both speed and comfort. However, use of a propeller provides more static thrust for a given amount of power (and fuel) and thus aids the take-off performance of a heavily loaded airplane. Furthermore, a speed of 450 m.p.h. permits the use of a straight—rather than swept—wing, with consequent substantial advanfage in the lift ability compared to weight.

"Considering these fundamentals it is obvious that, in a general way, the turboprop is better for cargo airplanes, and, in some areas, the jet is better for passenger airplanes.

"The needs we see appear to us at Douglas as follows: Long-range jet transports, such as those now on order, will evidently be the standard for trunk line express operations. The airlines which are generally known as trunk lines do, however, operate in areas other than long range express—or non-stop—services. For such services, where ranges may be up to 2,000 miles, where maximum speed and comfort will be demanded, but where traffic density is inadequate for economic use of the large jets, it appears a smaller jet transport is called for. As we reach down to the medium and short range operational requirements of the trunk carriers, the combinations of range, block speed, and costs indicate use of a turboprop airplane. As we survey the requirements of airlines which compete over the medium and short range routes with the trunk lines, it appears that competition will be the driving force which will demand the medium range jet and the short and medium range turboprop.

"Perhaps the most significant development could take place with the arrival of medium sized transports in the STOL class equipped for operating in the less developed areas of the world."

Mr. Raymond concluded his lecture with an assessment of the future world route structure. We hope to summarize this section next week.

CIVIL AVIATION

POSTSCRIPT TO THE B.O.A.C. REPORT

EXCEEDING even the most hopeful expectations, B.O.A.C. wound up its accounts for 1956-57 with a net profit of £303,352. Thus the Corporation actually found itself in the bizarre position of having to explain away a profit, because when the new chairman, Mr. Gerard d'Erlanger, came to office in June 1956, he took a quick look round and forecast a loss of £1½ million.

If a loss had in fact occurred, B.O.A.C. could have found plenty of excuses. For example, their report might have cited the stop-start stop-start stop-start of the Britannia 102 programme; the political disturbances in the Middle East; the credit squeeze; the inflationary rise in the cost of almost every item in the operating account; the shortage of aircraft capacity; the refusal of the U.S. Government to grant transatlantic fare increases; and so forth.

The fact that a profit was achieved in the face of these circumstances is most creditable, especially as the profit was the highest achieved since the year 1953-54, when Comets were sweeping in the revenue.

B.O.A.C. "explains away" its profit by a two per cent increase in total load-factor, which went up from 61.7 per cent to 63.7 per cent. Those who are surprised that one more seat filled per flight (which is roughly what a two per cent higher load factor amounts to) means £1½ million more revenue can do a simple sum from the statistics in B.O.A.C.'s report. Total scheduled capacity ton-miles were about 275 million. Load ton-miles—giving the load factor of 63.7 per cent—were slightly more than 175 million. Thus had the load factor been two per cent less, L.T.Ms would have been about 169½ million—i.e. 5½ million less than achieved. At B.O.A.C.'s revenue rate of 63.9 pence per L.T.M. this difference amounts to about £1½ million.

The most striking increase in revenue came from passengers: the sum of £32½ million was 19.1 per cent above the figure for the previous year. The passenger load-factor (as opposed to the total load factor) actually rose from 62.2 per cent to 66 per cent. As last year, more than half B.O.A.C.'s passengers (57.4 per cent) travelled tourist-class. Revenues from freight and mail went up respectively 14.7 per cent and 4 per cent. The latter figure was a disappointingly small increase, even though mail revenue, load for load, is worth more than passengers.

Three reasons for the big growth in revenues are given as the introduction of immigrant fares to the U.S.A. and Canada in November 1956; "an intensified sales campaign on all routes"; and business diverted from the sea during the Suez crisis. Evidently B.O.A.C. was the one British commercial undertaking which actually profited from Suez.

The refusal of the American Government to agree to the 5 per cent transatlantic increase proposed by I.A.T.A. may cost B.O.A.C. as much as £½ million during the current year. Nevertheless, along with other airlines, B.O.A.C. looks forward to introducing the new thrift-class fares, 15 to 20 per cent below existing tourist levels, providing that there is "a proper economic relationship between the different classes of travel."

The fact that B.O.A.C.'s maintenance costs are, as admitted by Mr. Basil Smallpeice, the managing director, to be "higher than those of our competitors," suggests that the Corporation might first reduce its costs before advocating the increase of its prices. Maintenance costs, at about £11½ million, leapt 17 per cent above last year's costs, and accounted for a quarter of the total expenditure. (PanAm's maintenance costs are about a tenth of total costs.) But there is no doubt that B.O.A.C. are keenly conscious of their shortcomings in this respect; in his letter to the staff, Mr. Smallpeice wrote: "Unless we can soon improve our methods so as to produce about double the aircraft hours for the same overall cost, we shall never be fully competitive."

Mr. d'Erlanger concluded his 1956-57 report with a note of warning. "The Corporation has embarked on a heavy programme of re-equipment. The introduction of new aircraft inevitably brings in its train an initial period of high cost operation, and this is likely to have an adverse effect on our immediate financial results." At his press conference last week, the chairman hinted at a possible deficit in the current year, 1957-58.

[*Leading article, page 469; B.O.A.C.'s Future Aircraft Policy, page 497.*]

Above, Bristol's chief test pilot Walter Gibb hands over the flight manual of B.O.A.C.'s first Britannia 312, G-AOVB, to the chairman, Mr. Gerard d'Erlanger, at London Airport on September 10. Capt. A. Meagher and Mr. Basil Smallpeice look on. Below, de Havilland's chief test pilot John Cunningham hands over the flight manual of B.O.A.C.'s first Comet 2E, G-AMXK, to Capt. Peter Cane at Hatfield on August 26. The Corporation restarted Comet services—daily 2E flights without passengers to Beirut and back to amass Avon RA.29 hours (fitted in the outboard nacelles)—on September 16.

B.O.A.C. IN 1956-57

Traffic	
Capacity ton-miles flown	282,134,827
Revenue load ton-miles flown	182,378,888
Revenue load factor	63.7 per cent
Seat-miles available	1,817,464,853
Revenue passenger-miles	1,254,744,184
Total aircraft miles flown	42,589,890
Passengers carried	409,684
Other load (tons):—	
Baggage	856.3
Mail	4,145.4
Diplomatic bags	67.1
Commercial freight	7,483.8
Total revenue "dead" load (tons)	12,552.6
Revenue per load ton-mile	63.9 pence
Costs per capacity ton-mile	39.9 pence
Passenger revenue per passenger-mile (scheduled services only)	6.5 pence
Average passenger mileage	3,031
Unduplicated route mileage	63,418
Total number of personnel (at 31.3.57)	19,046

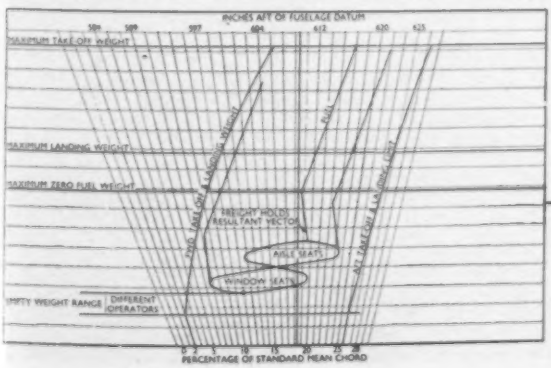
Financial	
* Total borrowings	£80,829,376
Capital and other reserves	£1,588,114
Total capital	£82,417,490
Revenue:—	
Passenger and excess baggage	£33,208,122
Mail and freight	£14,430,044
Non-scheduled services	£948,752
Incidental revenue	£417,793
Total revenue	£49,004,711
Expenditure:—	
Aircraft operating costs	£30,348,697
Passenger services and station costs	£6,072,093
Selling costs	£6,917,032
Training and development	£1,132,597
Central admin. and supplies	£2,471,800
Non-operating expenditure	£286,465
Total expenditure	£47,228,684
Interest on capital	£1,472,675
Net profit	£303,352

* The maximum borrowing powers of the Corporation were increased by the Air Corporations Act, 1956, from £80 million to £160 million.

All this FREIGHT from a PASSENGER aircraft?

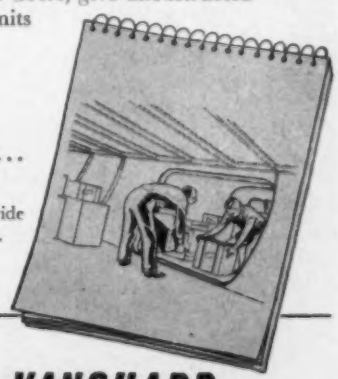
Yes, it's the VANGUARD

The ability to carry up to 120 passengers or ten tons of freight (density 15 lb. per cubic foot), will ensure profitable operation of the VANGUARD, winter and summer, day and night — even when passenger traffic is at its lowest ebb. With a combined capacity of 1,360 cubic feet, the two spacious holds in the 'double-deck' fuselage give ample room to arrange the freight conveniently in separate destination groups. The exceptionally wide freight doors, situated on the side opposite the passenger doors, give unobstructed access for simultaneous loading and unloading. The very wide C.G. range permits maximum flexibility of passenger and cargo loading. The 'loading loop' below shows the ideal matching of the C.G. limits which is possible with the Vanguard — yet another reason why the Vanguard is the airline's airliner.



For your notebook...

Each freight hold has an unobstructed access 5ft. 6in. wide and 3ft. 10in. projected height. Headroom inside is 4ft. 3in.

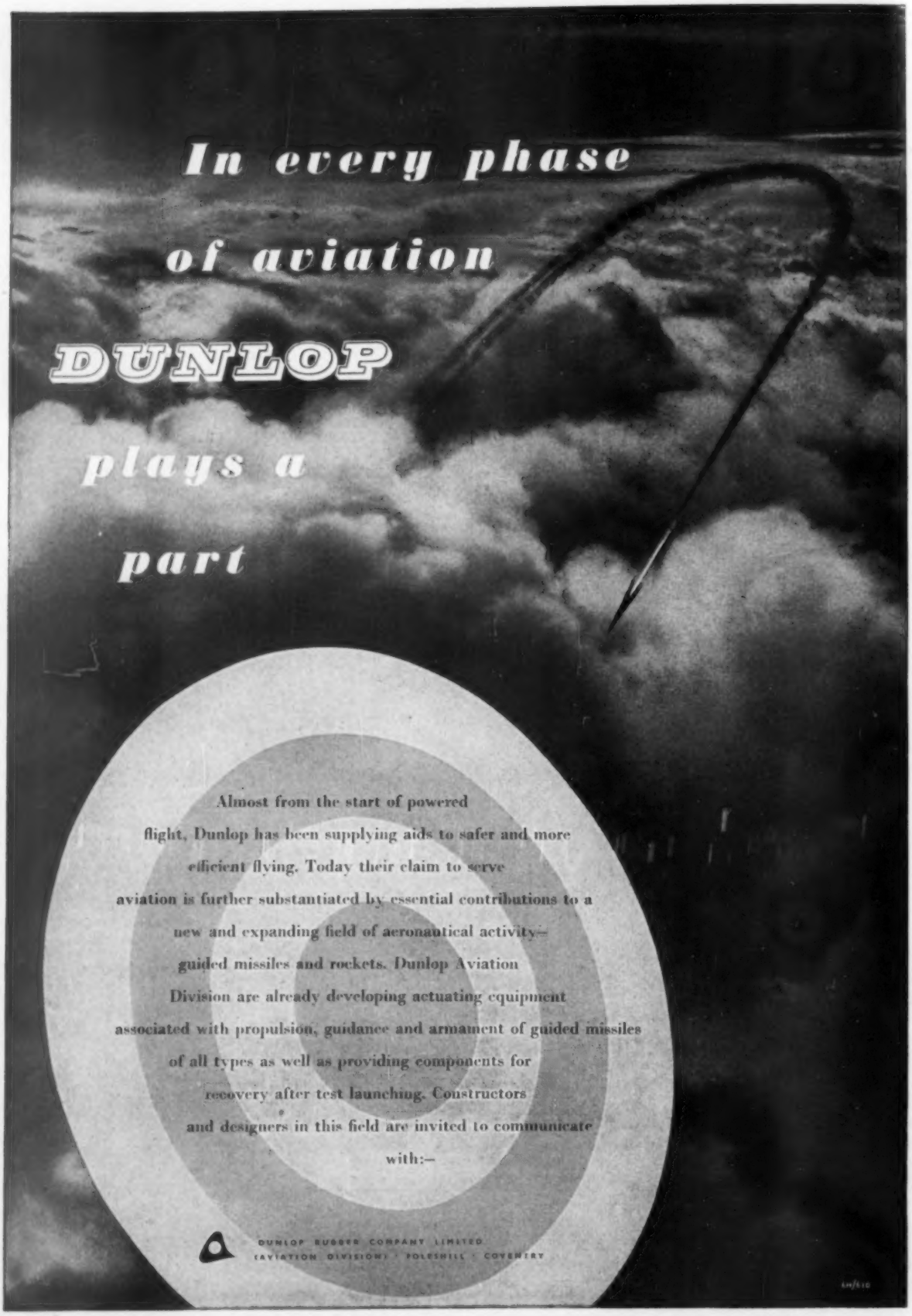


VICKERS VANGUARD

Four Rolls-Royce Tyne Propeller-Turbine Engines

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

TGA AT518


In every phase
of aviation
DUNLOP
plays a
part
Almost from the start of powered flight, Dunlop has been supplying aids to safer and more efficient flying. Today their claim to serve aviation is further substantiated by essential contributions to a new and expanding field of aeronautical activity—guided missiles and rockets. Dunlop Aviation Division are already developing actuating equipment associated with propulsion, guidance and armament of guided missiles of all types as well as providing components for recovery after test launching. Constructors and designers in this field are invited to communicate with:—
DUNLOP RUBBER COMPANY LIMITED
(AVIATION DIVISION) · POLESHILL · COVENTRY

CIVIL AVIATION . . .

Quotations from Madrid

NO momentous decisions were made at the 13th Annual Meeting of I.A.T.A., the five-day session of which was concluded at Madrid last Friday. As is customary, the proceedings were devoted mainly to the hearing and approval of the year's behind-the-scenes work by the specialist committees. The chairman of each committee made his report, and salient quotations are given here, together with others from the retiring president, Lord Douglas, and the president-elect, Sr. Tomás Delgado. (We recorded last week some of the remarks made by the director-general, Sir William Hildred, in his inaugural report.)

Lord Douglas of Kirtleside (Retiring President): "Looking back over the past year, I cannot pretend that either of these problems [air navigation and the commercial aspects of introducing jets] has moved very far towards a solution."

"I must speak very bluntly and say that in my view the governments of the world—collectively—have failed to provide the world-wide pattern of ground facilities essential to the development of civil aviation, and which under the Convention they undertook to provide. It is a very serious matter for the industry that we are now obliged to consider the provision *by the airlines themselves* of certain ground facilities in order that the progress of air transport shall not be held back."

"Equipment decisions are being debated in board rooms all over the world . . . Might not all our plans be somewhat different if we had more open discussions with our competitors about the best line of future commercial development? . . . If there is no fare differential between jets and other kinds of aircraft, it seems clear that the jet will have a substantial advantage on the longer routes . . . but if I suspect that my competitors are likely to use jets on routes of 500 miles or less, that is the assumption I must make in my future planning. Where is the dividing line? Would it not be highly desirable . . . to provide a forum for a complete exchange of ideas . . .?"

"I think it was unfortunate that this action [the C.A.B.'s rejection of I.A.T.A.'s proposed transatlantic fare increases] should have been taken unilaterally by one government."

Sr. Tomás Delgado (President-Elect): "Governments may rest assured that any applications for fare increases are the result of careful study. Proof of this lies in the fact that although . . . expenses . . . are increasing, tariffs have remained stationary for many years . . . and there have been cases where we have been able to reduce fares."

"We in Iberia [as operators of both short-haul domestic and long-haul overseas services] are in an excellent position to realize the complexity of the problems involved in fixing a universal pattern for fares. The Association's negotiations are daily becoming more complicated, and the tendency is towards even greater difficulty in the future."

During his closing speech last Friday, Sr. Delgado said: "The industry has demonstrated several times over its unusual capacity to digest large doses of progress in a short period. We have done it before. We will do it again. If we get the support which we need from the governments . . . we shall be all right. If not, our flight may be a good deal more bumpy and difficult, and our arrival in the jet age will be somewhat delayed. But whatever happens you can be assured that we will get there in good shape . . ."

Sr. Gregorio Obrégon (Avianca), Executive Committee: "The airlines have a hard task ahead to convince governments that an increase in airport charges would be detrimental to the sound development of international air transport."

"Facilitation and the reduction of red tape has progressed further in Europe than in most areas."

"The adoption of the principle inherent in the C.A.B.'s action by other governments could lead to the complete undermining of the I.A.T.A. rate structure."

Mr. W. A. Steenstra-Toussaint (K.L.M.), Legal Committee: Lease of aircraft with crew by one airline to another created legal problems as to liability, and "there are situations which might not satisfactorily be resolved under the present Warsaw Convention, to which some supplement might be advisable."

Mr. A. V. Leslie (T.W.A.), Financial Committee: "There is concern over the amount and extent of taxation on the gross receipts of the airlines." Efforts recommending the elimination of this form of taxation had borne little fruit. These efforts "are not set up to avoid taxation . . . but to ensure that it is non-discriminatory."

"Increases in the scale of landing and other airport charges have ranged from 20 to 75 per cent over the last year." Similar anxiety was expressed at the possibility of certain governments imposing passenger service charges.

Capt. A. V. J. Vernieuwe (Sabena), Technical Committee: I.A.T.A.'s Turbine-powered Aircraft Operations Panel had produced a reference document "to assist airlines in their own initial planning and to provide guidance to governments."

"The prospects of our being able to utilize wholly self-contained aids—especially those based on the principles of Doppler radar—are distinctly brighter."

Requirements for route familiarization are "on the way out, at long last." Responsibility would now be placed upon the operators.

"Our very considerable efforts in this field [approach and landing aids] have been time and money well spent."

I.A.T.A. had been a "prime mover" in the "narrow-gauge" touchdown area lighting scheme, and also in that for "fixed distance" runway markings 1,000ft beyond the threshold as an undershooting-deterrent.

"Today at our airports we are faced with the classic problem of pouring more and more peas into the mouth of a funnel while trying to speed up the rate at which they trickle out the other end—without using a larger funnel."

On airworthiness, I.A.T.A.'s viewpoint was that there should be "a single world-wide method of compliance."

"There has been much erroneous speculation regarding the length of runways required for jets . . . At the majority of . . . aerodromes, aircraft will be taking off at substantially less than maximum weight and will correspondingly require substantially shorter runways."

Footnote

Next year's annual meeting will be held in New Delhi, starting on October 27. The President-Elect is Mr. J. R. D. Tata, Air-India. Tokio has been chosen as the 1959 meeting-place.

Manufacturers were represented at Madrid as follows: U.S.A., ten firms, 68 delegates; United Kingdom, two firms (Vickers-Armstrongs (Aircraft), Ltd., and Rolls-Royce, Ltd.), nine delgates.

Lord Douglas of Kirtleside, retiring President of I.A.T.A., addresses the 13th Annual Meeting at Madrid. Also pictured (from left to right): Sir William Hildred, Director-General of I.A.T.A.; Count Mayalde, Mayor of Madrid; General Dias de Lecea, Spanish Air Minister. Sr. José Pazo Montes, President of Aviacion y Comercio, sits to the left of Lord Douglas.

DIFFERENTIALS FOR TURBOPROPS

IT is usually possible to guess the attitude of an operator or a manufacturer to differential fare-structures for jets and turboprops by knowing where his affiliations lie. Protagonists of the turboprop—afraid of losing traffic to the jets—will advocate differential fares on the grounds that the turboprop is cheaper to operate than the jet and that these lower costs should be passed on to the consumer in the form of lower fares. The jet case, on the other hand, will be that differential fares would amount to putting an unfair premium on jet travel.

This question of differential fares was among the subjects of discussion in a recent B.B.C. programme, when Mr. Peter Masefield, managing director of Bristol Aircraft, and Mr. Anthony Milward, chief executive of B.E.A., discussed with Mr. F. Besancon, executive vice-president of K.L.M., the future pattern of air travel. Mr. Masefield said that he believed that if the fare was £25 cheaper many passengers would choose to fly in an aircraft which travelled 150 m.p.h. more slowly and took two hours longer. He was supported by Mr. Milward, who said: "We would like to see the public benefit from slower speed if it is economic, but we are up against vested interests in I.A.T.A."

HERCULES IN MUFTI

A COMMERCIAL version of Lockheed's C-130 Hercules was announced by Mr. Carl Kotchian, vice-president and general manager of Lockheed's Georgia Division, earlier this month. Delivery in 1960 is offered. It will be basically similar to the C-130B, but it will be powered by the 501-D22 civil version of the 4,050 e.s.h.p. T56-A-7 Allison military turboprop. An application for type certification was submitted to the C.A.A. a year ago, since when the Administration has witnessed various tests both on the engines and the C-130A airframe. Lockheed's say that a good deal of progress has been achieved and the foundations have been established for "smooth and rapid C.A.A. certification when the proper time arrives." The commercial aircraft, designated Model 282A, will be able to carry its maximum payload of 45,000 lb over 1,750 miles, and payloads of over 32,000 lb for more than 3,000 miles. The normal cruising speed will be 350 m.p.h. at 30,000ft. The initial cost is likely to be just over £700,000, and an operating cost of 5.3 pence per ton-mile is envisaged.

Lockheed's have appointed Mr. Robert F. Stoessel as civil Hercules sales manager.

The first Britannia for export, El Al's first 313 4X-AGA, is seen here at Bristol on September 12 shortly before taking off for Tel Aviv. El Al reckon to start transatlantic services on December 1.

CIVIL AVIATION . . .

707s FOR VARIG

VARIG Airlines of Brazil, who have for some while been making a close study of the jet-transport market (an order for Convair 880s recently seemed a strong possibility, and Comets and Caravelles have also been mentioned) have now signed a purchasing agreement with Boeing for three 707 Intercontinentals with 110-seat interiors to be delivered from July 1960. It is not known if these will be the 320 or 420 versions, as the choice of powerplant—Pratt and Whitney JT4s or Rolls-Royce Conways—is as yet undecided. The value of the order, including spare parts and engines, is about £7,160,000.

Varig's 707s will be used on new 9½-hour non-stop "de luxe" services between New York and Rio de Janerio, and will about halve the time taken on this route by the airline's three Super-G Constellations, which make stops at Belem in Brazil and Cuidad Trujillo in the Dominican Republic. The airlines domestic routes are flown by Convair 240s, C-46s and DC-3s. Varig have a further two Super-Gs on order.

CATHAY PACIFIC BUYS ELECTRAS

THE British independent airline Cathay Pacific Airways of Hong Kong is to buy two Lockheed Electras for delivery in June and August 1959. At present Cathay Pacific operate one DC-3, one DC-4, and one DC-6. A DC-6B is on order for delivery in 1958. Based in Hong Kong, Cathay Pacific operate services to Bangkok, Calcutta, Labuan, Manila, Rangoon, Saigon and Singapore.

The order brings the Electra order-book to 140.

THE BIG DOLLAR DEAL

FURTHER chapters have been added to the Howard Hughes-Britannia story. They concern the financial penalties Mr. Hughes would have to pay to get the 15 Britannia 310s he wants for T.W.A. by next summer.

Recent reports have been unanimous in suggesting that, if he is to secure early delivery of Britannias at the expense of other airlines, Mr. Hughes would be asked to pay heavy compensation to the customers he had queue-jumped. Referring to these reports at his Press conference in London last week, Mr. Gerard d'Erlanger, chairman of B.O.A.C., said that he would not stand down in favour of T.W.A. unless the Government considered it necessary for him to do so in the national interest. In that event, B.O.A.C. would certainly want financial compensation. It is reported, however, that Hunting-Clan and the Government (for the R.A.F.) might be prepared to accept a delay in their Britannia deliveries on payment of compensation.

But Mr. Hughes, undaunted, is said to have offered four Constellations (presumably 049s or 749s, of which T.W.A. has 71) for each Britannia anyone might be prepared to give up. This offer was evidently aimed at El Al, who have three 049s; and in terms of cash it meant that Mr. Hughes was quite happy to pay about double the Britannia's market price. El Al—who took over their first Britannia 313 on September 5 (see picture above)—apparently found no difficulty in turning the offer down.

Reports of Pakistan Air Lines' interest in the Fokker Friendship are lent weight by the visit of the Pakistani ambassadress to the Netherlands, Begum Liaquat Aly Khan, to Schipol on August 30. The Begum is seen here by the aircraft with Fokker and Pakistani officials.

NEW GROUND SERVICES CONTROLLER

THE Minister of Transport and Civil Aviation has appointed Mr. E. A. Armstrong, C.B., C.B.E., as Controller of Civil Aviation Ground Services in succession to Sir Alfred LeMaitre, K.B.E., C.B., M.C., who is retiring at the end of the month. Mr. Armstrong has been in charge of the Civil Aviation Safety and General Group, with special responsibility for overseas ground civil aviation facilities, since the Ministries of Transport and Civil Aviation merged in 1953. Sir Alfred has been Controller of Civil Aviation Ground Services since July 1948.

THE CARAVELLE IN DEMAND

THE possible T.A.A. order for Caravelles is the subject of renewed speculation in the American *Aviation Daily*, which reports that the airline's choice now lies between the French jet airliner and the Lockheed Electra. Mr. W. McDonald, chairman of the Australian National Airlines Commission, is quoted as saying that a final decision may be expected before December 31, when T.A.A.'s option on two Caravelles expires. As previously reported in *Flight* (August 16), a verdict in favour of the Caravelle depends on the aircraft's ability to carry full payload on the Adelaide-Perth stage (1,320 st.m.), and also on whether "certain other modifications" can be made.

The Caravelle has another prospective customer: Aero O/Y-Finnair has asked the Finnish government to approve the purchase of three aircraft for delivery in 1959. Finnair would operate its Caravelle fleet on international services at present run in association with K.L.M. and B.E.A.) from Helsinki to London *via* Copenhagen, Hamburg, Amsterdam and Paris. Convair Metropolitans are at present used on these services.

T.E.A.L.'s FLEET PLANS

A HINT that T.E.A.L.'s re-equipment policy might be decided entirely from the New Zealand side of the Tasman Sea was given recently by Sir Leonard Isitt, chairman of the T.E.A.L., who mentioned that transport re-equipment proposals for the airline should take into account closer association with the R.N.Z.A.F. Sole ownership of T.E.A.L. by New Zealand has long been advocated by the airline, and this view seems to be receiving increasing support in Australia. Integration between the requirements of the airline and the R.N.Z.A.F. would mean that T.E.A.L.'s utilization problems—it has been estimated that three modern jets or turboprops could handle the whole of the air and sea traffic potential over the Tasman—might be largely solved.

THE TU-104 ON AMERICAN SOIL

ON September 8, the first Soviet passenger aircraft ever to have landed on United States soil arrived back in Moscow, leaving behind it a trail of repercussions.

Originally the Russians wanted the Tu-104—bringing Soviet delegates to the United Nations in New York—to land at Idlewild. The Port of New York Authority refused permission because the aircraft had not passed the noise tests required of all jet airliners (including American) using Idlewild. Despite Russian objections, the Tu-104 had to put down at McGuire Base in New Jersey, a 60-mile drive from Manhattan.

On his return to Moscow, the captain of the Tu-104 stated that American jet bombers, "obviously interested in data concerning our plane," had tried to shadow them on the last lap of the outward journey, but "we increased speed and left them behind." A U.S. Air Force spokesman subsequently denied that any such trailing occurred.

Reporting the Tu-104's flight, Moscow Radio is quoted as saying that the aircraft was banned from landing at Idlewild "not because of the noise factor, but to prevent a public display of admiration of the Soviet airliner." A crowd of several hundred is reported to have witnessed the Tu-104's arrival at McGuire U.S. Air Force Base.

B.O.A.C.'s FUTURE AIRCRAFT POLICY

DISPLAYED at the B.O.A.C. Press conference in London last week was an illuminating graph (reproduced here) forecasting the future growth of B.O.A.C.'s passenger traffic. This anticipates that in 1966-67 B.O.A.C.'s traffic will be 5,750 million passenger-miles. Thus, during the next ten years, the Corporation is planning on a 400 per cent increase in its business. The remarkable fact emerges that, to achieve this, B.O.A.C. will have to increase their traffic at an average annual rate—every year for the next ten years—of no less than 20 per cent.

The graph incidentally provides the answer to the suggestion made in *Flight* of June 7 that B.O.A.C. have too many aircraft on order. In that issue (page 784) we wrote:—

"It seems highly unlikely that B.O.A.C. can count on a 20 per cent annual rate of traffic-increase up to 1965; but even assuming this, Britannia 312s and Comet 4s would still have to be disposed of to avoid excess capacity. The conclusion seems clear: B.O.A.C. must be planning on an all-jet fleet of 707s and VC-10s. And they appear to be counting on big increases in traffic to fill them."

Asked at the conference whether his Corporation was planning on the long-term development of long-range turboprop operations, Mr. d'Erlanger replied: "That is the 64,000 dollar question, but I would say yes, we expect to go on with Britannias as far ahead as we can see."

It is therefore of interest to examine B.O.A.C.'s graph to see roughly how the aircraft capacity on order will match up to the traffic. Does the curve appear to indicate that B.O.A.C. are in fact planning on an all-jet fleet of 707s and VC-10s?

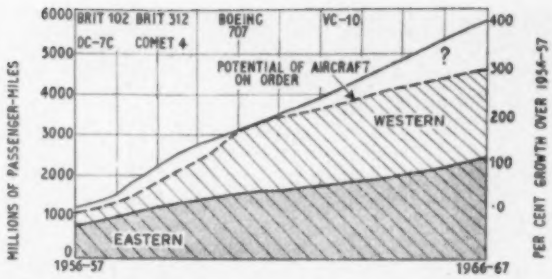
It goes further than that: indeed it appears to indicate that B.O.A.C. are planning on an all-VC-10 fleet. In 1966-67 (the graph estimates) traffic will be 5,750 million passenger-miles. To carry this, assuming a passenger load factor of 65 per cent, an aircraft capacity of 8,850 million passenger-miles will be required.

According to our sums, this is exactly the amount of capacity represented by the 15 Boeing 707s and the 35 Vickers VC-10s B.O.A.C. have on order:—

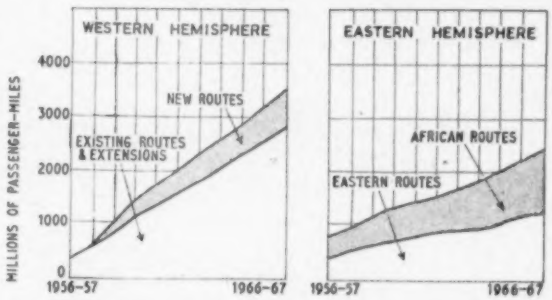
Aircraft	Seats	Block Speed (m.p.h.)	Utilization (hr)	Passenger-Mile Capacity (Millions)
35 VC-10	120	480	3,000	6,050
15 707	130	480	3,000	2,800
				Total: 8,850

But how is this conclusion reconciled with the dotted curve in the graph marked "Potential of Aircraft on Order," which shows an aircraft capacity (presumably load-factored) in 1966-67 of only 4,600 million passenger-miles?

The answer can only be that B.O.A.C. are planning to dispose of some Boeing 707s (the graph indicates eight or nine) by that date—presumably in accordance with a policy to concentrate on a one-type British-built jet fleet of VC-10s. Weight is lent to this assumption by Mr. d'Erlanger's remark (made at his Press conference) that Vickers "have hopes" of making the VC-10 into a transatlantic airliner.



Above, B.O.A.C.'s forecast of their traffic growth and aircraft capacity. The traffic growth is the sum of the two graphs below.



BREVITIES

SIR GEORGE EDWARDS, managing director of Vickers-Armstrongs (Aircraft), has forecast a total market for about 500 Viscounts. To date, 374 have been ordered.

* * *

T.C.A. have ordered 33 additional Collins AP-101 autopilot systems for their Viscounts.

* * *

Next year K.L.M. is to operate a Polar service from Amsterdam to Biak, Dutch New Guinea, *via* Tokio with DC-7Cs.

* * *

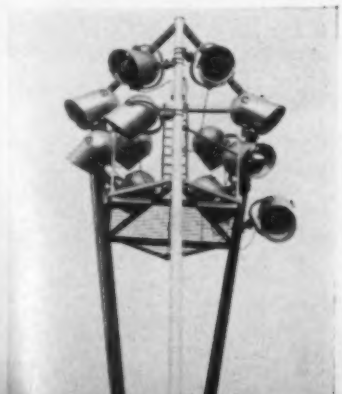
The Smith's S.E.P.2 autopilot has been granted C.A.A. approval. First deliveries to the U.S. will be in Northeast's Britannias.

* * *

Isolated cases of flame-outs in the Avon engines of Comets flying through tropical storms are reported to have occurred on two occasions. It is understood that Rolls-Royce have adopted an inlet guide-vane setting modification to solve the trouble.

* * *

A report by C.A.B. to be presented to I.A.T.A. in Madrid on September 24 states there appears to be no economic justification for increased air fares in Europe and America. The Board says it believes the present excursion rate is essential for tourist trade promotion and is economically sound.



New York Idlewild has installed this type of lighting to flood the whole terminal area. It is designed to avoid upward-glare.

Pilots of B.W.I.A. have accepted offers of arbitration on a pay dispute. The officers claim substantial increases following those given to B.O.A.C. pilots last year.

* * *

An order for jet thrust reversers for the Convair 880, worth over £3 million, has been placed with the General Electric Company by the Convair Division of General Dynamics Corporation.

* * *

The newly-merged Italian airline, A.L.A.I., is expected to place an order for a fleet of DC-8s within the next few weeks. As reported earlier (*Flight*, August 30), the five L.1649As ordered by L.A.I. will probably be sold to the Venezuelan airline, LAV.

* * *

I.A.T.A. have published the first number of World Air Transport *Statistics*. The major part of the issue is devoted to the operating statistics of individual member airlines as reported annually by them. The mid-year I.A.T.A. *Bulletin* is now discontinued.

* * *

The M.T.C.A. has issued *Aeronautical Information Service Bulletin No. 3301* about N.A.T.O. air exercises over Norway, the Norwegian Sea, English Channel, North Sea, United Kingdom, Ireland and the Bay of Biscay. The exercises take place between September 19 and 29.

* * *

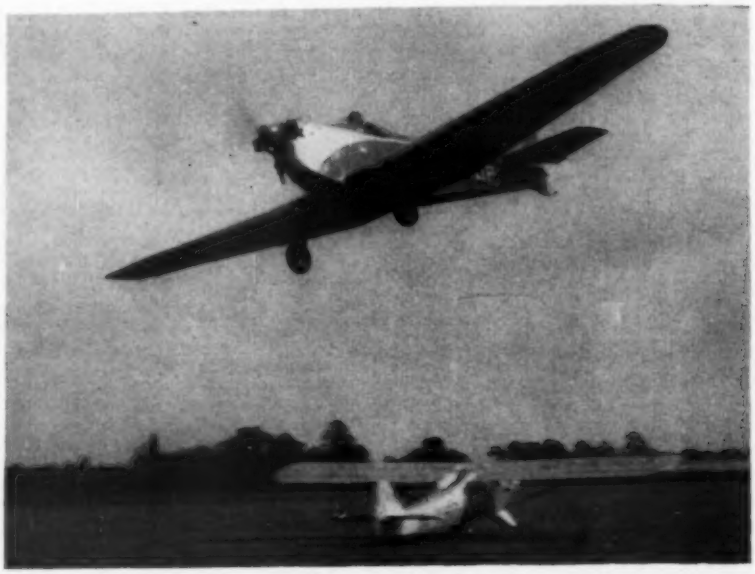
It is reported that English Electric, who have recently been advertising for civil-aircraft design staff, are expected to announce a short- to medium-range STOL civil transport. The company has also been seeking engineers with high-speed-flying design experience for civil design work.

* * *

Sir Roy Dobson, managing director of A. V. Roe, is quoted as having said that "From the fund of knowledge we have in our own company" and with Government support, a British supersonic transport could be flying, though not in operation, by 1961 or 1962. The range would be 1,500 n.m., and speed 1,200 m.p.h. (Mach 1.8).

Popular Flying Rally

LIGHT AIRCRAFT WEEK-END AT SYWELL



Sywell at last: Mohammed Rafique brings the Dart Kitten in to land after his struggle up from Thruxton at a ground speed of 28 m.p.h.

RALLYING is fun. And the National Air Rally of the Popular Flying Association last week-end—which brought more than a score of British and French competitors to Sywell aerodrome near Northampton—was very good fun indeed. The plot was simple; competitors could start from their home base and were required to do as much flying as could be done in a morning, visiting as many aerodromes as possible, before converging on the compulsory route control at Cambridge. From here, a triangular course (denoted by latitude and longitude cross references) was to be flown to Sywell, and there were objects to be identified at the turning points of each leg. Points were awarded for miles flown, landings made and passengers carried, with bonus marks for correct identification of the signs on the ground. The results were then calculated on a formula: the product of distance flown and seats occupied divided by engine horsepower.

The eventual winner, Rex Nicholls in Hawk Trainer G-ALIO, entered splendidly into the spirit of the regulations. When *Flight's* Gemini arrived at Shoreham from Croydon at an Early Hour (well, for a Saturday at least) to see if any P.F.A. competitors had passed through, Nicholls had long since completed the same course and was on his way to Bembridge. He also visited Thruxton, Kidlington, Fairoaks, Luton and Cambridge before arriving at Sywell. Barry Birch was another pilot who added a string of aerodromes to his logbook: Elmdon, Tollerton, Coventry, Kidlington, Staverton, Cranfield (where the Airways Aero Club were meeting), Cambridge and Sywell again. Both were excellent efforts, and Lewis with very much less power available in his Walter Mikron engined Tipsy G-AISA also managed to call at Staverton, Kidlington, Cambridge and Sywell en route from Cardiff. But the accolade must go to Mohammed Rafique who, with relative unconcern, brought the Dart Kitten up from Thruxton against a strong and gusty north-west wind. Nearly everyone complained of rough rides on the way but Rafique did a hero's job map-reading around the course, frequently using both hands to keep the playful Kitten level.

By mid-morning every aerodrome had entered into the spirit of the competition and route cards were being signed with an aplomb that would do credit to the Mille Miglia. At Cambridge, the staff were co-operating with an arrival and departures control from a special hut on the apron, although stops here were more protracted; maps, computers and protractors were flourished in odd corners as pilots and passengers plotted the turning points of the compulsory three-legged track. First at Cambridge was Happy Wanderer Nicholls, followed by Willink in Tiger Moth G-ANLG, Birch and his Argusnauts, and Andreanoff in the Whitney Straight.

More than the good visibility prevailing was needed to find all the signs on the ground. The first, "a series of numbers eighteen to twenty-five miles along the track" was at the butts of a firing range—but as they faced in the *direction* of the track they were not easy to spot. Accurate plotting of the next point brought competitors over the tiny Castle Mill aerodrome near Bedford, and in the middle of the field were two tractor tyres painted white. The third marker was a square. Not every sign had to be identified by every aircraft; types with less than 75 m.p.h. cruising speed were required to find two, only one of which was compulsory; but everyone faced quite severe marking penalties for arriving at Cambridge and Sywell outside their allocated hour.

Although some crews were late, all except the French entry had reached Sywell by three p.m. Hampered by various delays, the visitors arrived with little time to spare before dark. But the president of the R.S.A., M. Georges Beraud, brought a Jodel 121 (this is the version with the 75 b.h.p. Continental engine) all the way from Lyon. Among the three other Jodels was a D.119 from Berck, flown by M. Beraud's brother, and a very attractive blue and white 90 h.p. D.117 complete with spats and—like the other French aircraft—lots of spare inner tubes, piloted by M. Rollin. This aircraft was awarded the Kronfeld Tankard as winner of the Concours d'Elegance. Runners up were M. J. Barritault and his wife in the silver-grey and red Minicab GY-201, who were awarded a year's subscription to *Flight* and (as the result of a precautionary landing en route) a jerry can of petrol. Third place, and a subscription to *The Aeroplane*, went to the Jodel F-PHZH from Berck. The best British aircraft—placed fourth was Ivor Lewis' Tipsy.

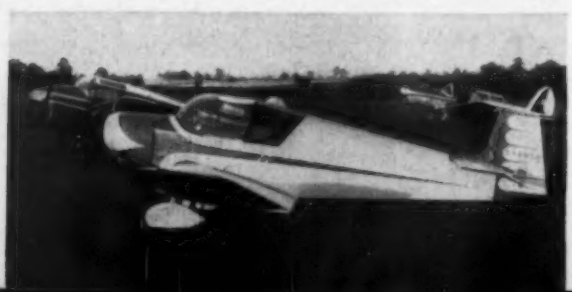
Other aircraft that rushed up to Sywell to see the fun were the exemplary Chipmunk of the P.F.A. president, Mr. Peter Masefield (who was accompanied by his son, Charles), an E.P.9 and an Irish-registered Bonanza from Croydon. Until dark, most of the visiting aircraft were surrounded by little knots of informed and interested spectators. The Coventry-Victor Turbi built in the Isle of Wight by Britten-Norman attracted a good deal of attention, as did the very attractive Jodels and Minnicab from France, but modern home-built British aircraft are still depressingly conspicuous by their prolonged absence.

In the evening, a dinner and prizegiving were held in the club house of the Northampton Aero Club. Speaking in characteristic vein after dinner, Mr. Masefield—who, as managing director of a major aircraft company, still finds time to be a very active and approachable president of the P.F.A.—commented that there were 450 home-built aircraft actually flying in France. Getting people into the air was a national task.

Prizes were awarded to Nicholls, a worthy winner with 44.6 points; to current air racing champion Brian Iles, who was second in the M-18 with 22.5 points; and to Watson in the Tiger Moth who with 12.26 points was third.

(Left) The president of the Popular Flying Association, Peter Masefield, arrives by Chipmunk with his son and is greeted by Maurice Imray.

Concours d'Elegance winner (below) was M. Rollin's dainty Jodel D.117



TIP THRUST UNITS FOR THE 'SKEETER'

Napier helicopter tip thrust units, using liquid propellant, have been fitted to the Saunders Roe 'Skeeter' light helicopter. They are the simplest, lightest and most compact means of providing additional independent power for the special conditions experienced in helicopter operations.

'SCORPION' FOR THE CANBERRA

Installed in the belly of an English Electric Canberra, the 'Scorpion' rocket engine is used as a boost for additional thrust at take-off and at high altitudes. Rocket engines are also a source of extra speed for fighter aircraft in combat.

POWER FOR TOMORROW'S AIRCRAFT

Following the success of the Napier thermal ignition engine as a propulsion unit for guided missiles, Napier are now developing a range of rocket engines for high-speed piloted aircraft. Operating on gas-turbine fuel and high-strength hydrogen peroxide, these engines are capable of repeated start-stop sequences with complete reliability at any altitude.

Napier engineers are also engaged on the design and development of ram jet engines for aircraft propulsion.

NAPIER

ROCKET ENGINES

TIP THRUST UNITS

RAM JET ENGINES

D. NAPIER & SON LIMITED · LONDON · W.3

CRC 529

AVRO AIRCRAFT LIMITED
CANADA

Member: A. V. Roe (Canada) and the Hawker Siddeley Group

requires

MATHEMATICIANS

AERODYNAMICISTS

ENGINEERS

for Tactical Evaluation Group and Aeroelastics Section

SENIOR PERSONNEL ARE REQUIRED FOR:

The evaluation of the tactical performance capabilities of supersonic weapon systems.

Studies of fire control effectiveness and data presentation.

Studies in air strategy.

Simulation studies of tactical problems.

The Company's extensive analogue and I.B.M.704 Digital Computing facilities are available for these studies.

Applications are invited from personnel with experience in one or more aspects of this type of work.

BENEFITS INCLUDE: Company-paid group life, sickness and accident insurance for you and your dependants, 8 statutory holidays with pay plus two weeks vacation with pay after one year. Contributory pension plan after two years.

Cost of transportation to Canada of successful applicants and families will be paid by the Company.

Assistance given in securing living accommodation.

APPLICANTS are invited to write, stating particulars of experience and qualifications, or personally call for application forms at Avro Aircraft Limited, Department 292, c/o Ontario Government Immigration Department, 12 New Burlington Street, London, W.1.

Selected applicants will be interviewed in the United Kingdom at an early date.

AVRO AIRCRAFT LIMITED

Frankly, we're not very clever at jigsaws. But when it comes to putting *other* things together we do know our stuff! In addition to producing a whole host of fasteners for everything from automobiles and domestic appliances to clothing and military equipment, we keep our designers incredibly busy—developing new projects for those who want the near-impossible! Perhaps we can be of service to *you* . . .

* *TRADE ENQUIRIES ONLY.*

TRADE DOT MARK

THE CARR FASTENER CO. LTD.

47 WOBURN PLACE, LONDON, W.C.1. MUSeum 1433

Nottingham: Stapleford, Sandiacre 3085
Manchester: 50 Newton St., Manchester, 1. Cen. 4057
Birmingham: 214/5 Daimler House, Paradise Street, Birmingham, 1. Midland 2297

D.11

FLIGHT and AIRCRAFT ENGINEER

PRESS DAY — *Classified advertisement "copy" should reach Head Office by* FIRST POST THURSDAY *for publication in the following week's issue subject to space being available.*

CLASSIFIED ADVERTISEMENTS

Advertisement Rates. 5/- per line, minimum 10/-, average line contains 6-7 words. Special rates for Auctions, Contracts, Patents, Legal and Official Notices, Public Announcements, Public Appointments, Tenders 6/- per line, minimum 12/-. Each paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1.

Postal Orders and cheques sent in payment for advertisements should be made payable to Iliffe & Sons, Ltd., and crossed & Co.

Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

Box Numbers. For the convenience of private advertisers, Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000, c/o Flight," Dorset House, Stamford Street, London, S.E.1.

The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

SAMLESBURY ENGINEERING

AIRCRAFT CONSTRUCTORS

for all types of

C. of A. OVERHAULS
CONVERSIONS · REPAIRS
MODIFICATIONS

Designers and Manufacturers

of

JIGS and TOOLS

for the

LEADING AIRCRAFT MANUFACTURERS

Also

SUPPLIERS of MAJOR STRUCTURES, LARGE ASSEMBLIES and INTERIORS

A.R.B. Approved

Design & Drawing Office Facilities Available

SAMLESBURY AIRFIELD
Nr. BLACKBURN, LANCASHIRE
TELEPHONE: BLACKBURN 44668

Also at

SQUIRES GATE AIRPORT, BLACKPOOL
STANSTED AIRPORT, ESSEX

FLYING BOOTS No. 204

Lined throughout with soft luxurious sheepskin, these excellent boots have all leather uppers, leather sole, rubber heel, strap and buckle adjustment and exclusive calf retaining strap. Height from ground 15ins. FLYING BOOTS No. 203. Similar to No. 204 but 10ins. high and without straps. £4.17.6. Sizes, Ladies 3-9, Gents 5-12. **£5-19-6**

Terms to Flying Clubs. Trade Supplied. Send 4d. in stamps for illustrated catalogue.

D. Lewis LIMITED

(Dept. F.) 124 Gt. Portland Street, London, W.1.
Tel. Museum 4314. Grams: Aviakit, Wesdo, London.

AIRCRAFT FOR SALE

R. K. DUNDAS LIMITED

STRONGLY recommend the following selection from their large and varied stock of light, medium and heavy aeroplanes:

TWO very fine Douglas DC3s, recently passed 1,200 hours' inspection and overhaul, full radio, 28 seaters. £41,750 and £43,000.

TWO excellent well-equipped Avro XIX. £4,150 each:

(a) Engines Cheetah XV; port—nil, stbd.—236 hours; Airframe—2,767; Radio—Bendix S.C.R. 259, Bendix BC 357, Murphy MR 80, Bendix R.A.F. 1589/99; auto radio compass, 23 channel V.H.F., S.B.A.; metal tailplane; 9-10 seats; 12 months' C. of A.

(b) Engines Cheetah XV; Port—nil, stbd.—508 hours; Airframe—1,863; Radio—as for (a) plus Bendix B.C. 453; N/F receiver; metal tailplane; 9-10 or 6-8 seats. Metal wings available extra if required.

BRIEF operating data: Useful load, 2,981 lb.; range (6 passengers), 610 miles; take off, 50ft—700 yd; landing, 570 yd; cruising, 155 m.p.h.; stalling, 60 m.p.h.; climb, 750ft p.m.; ceiling, 19,000ft.

ONE Avro Anson Mark 1 in excellent condition, only £2,500.

ONE Auster V J/1 Autocrat in beautiful condition. £1,200. A superbly maintained 3-seater Auster V with C. of A. until March 1958, £1,100.

A NUMBER of Proctors of various marks, 2 Fairchild Argus, 1 Moth Minor, 2 Hornets, 2 Chipmunks, 1 Erco Ercoupe, 1 Miles Gemini.

R. K. DUNDAS, LTD., 59 St. James's Street, London, S.W.1. Tel.: HYDe Park 3717. Cables: "Dundas Aero," Piccy, London. [0559

EAGLE AIRCRAFT SERVICES, LTD.
Europe's Leading Viking Specialists
OFFER
VICKERS VIKINGS

WE can now offer for sale for delivery in October-November 1957: Three Vickers Viking Mark 1 36-seat Passenger Aircraft.

AT time of delivery each aircraft would have Major Check IV overhaul; 12 months British Certificate of Airworthiness; zero hours since overhaul engines and propellers; full airline radio including STR.12D V.H.F.; SR.14/15 I.L.S.; AD.7092 radio compass.

A COMPREHENSIVE spares holding, including power plants, would also be available for release at the same time.

OUR copyright freight door modification and new freight floor could be incorporated if required. Inspection invited. Full particulars on application to:

EAGLE AIRCRAFT SERVICES, LTD.,
BLACKBUSHE AIRPORT,
CAMBERLEY,
SURREY.
Cable: Eagle Camberley. Phone: Yateley 2371. [7089

TRAVELAIR, LTD.

OFFER Private, Executive, Commercial Aircraft.

NEW Auster Alfa, £1,765. Proctor IV, low hours, 12 months' C. of A., £450. Rapide Executive, full equipment and C. of A., £2,950. Tiger Moth, low hours, three years' C. of A., £425.

H.P. Terms gladly arranged.

TRAVELAIR, LTD.

115 Oxford Street, London, W.1. GER. 3382. [0610

VENDAIR OF CROYDON AIRPORT

OFFER

GEMINI Mark IA. Airframe hours 1,050 since new. Cirrus Minor II engines 230 hours and 80 hours. V.H.F. radio. Recent C. of A.; aircraft in excellent condition. Price £1,900.

AUSTER Mark V. Airframe 850 hours since new, Lycoming engine zero hours since complete overhaul; three seats; new C. of A. Price £1,000.

FIVE other aircraft in stock. Vendair, Croydon 5777. [0603

THE MINISTRY OF SUPPLY offers for sale two Valetta C. Mk. 1 aircraft lying near London. Applications for tender forms should be made in writing to Ministry of Supply, Disposals 3(a). First Avenue House, High Holborn, London, W.C.1. [7081

W. S. SHACKLETON LTD

DOUGLAS DAKOTAS

Immediate release of two C-47B Dakota aircraft fitted with Pratt and Whitney R1830-92 engines can now be made.

Maintained in superb condition, and operated on scheduled services, these 32-seat airliners will have a Check IV overhaul and zero hour engines and propellers fitted before delivery.

We are very proud to have been appointed to offer these aircraft for sale.

W. S. SHACKLETON LTD.,
175 PICCADILLY, LONDON, W.1
CABLE: "Shackhud, London"
PHONE: HYDe Park 2448-9

CROSS MFG. CO. (1938) LTD
COMBE DOWN, BATH
TEL: COMBEDOWN 2355/8

AIRCRAFT FOR SALE

D. H. DOVE, Queen 70/4 engines. Available immediately. Channel Airways, Southend Airport, Essex. [0031

PIPER AIRCRAFT. Tri-Pacers—Apaches—Super-Cubs. The sole agents for Great Britain and Ireland are Irish Air Charter Limited, 62 Merrion Square, Dublin. Tel. 63297. [0200

AIRCRAFT WANTED

W. S. SHACKLETON, LTD., are always in need of civil aircraft of all types to fulfil inquiries at home and overseas.

W. S. SHACKLETON, LTD., 175 Piccadilly, London, W.1. Cable: "Shackbud, London." Tel.: HYDe Park 2448-9. [0073

AIRCRAFT ACCESSORIES AND ENGINES

A. J. WALTER, A.J.W. (Instruments), Ltd.

AIRCRAFT spares.

ENGINE spares.

ACCESSORIES.

INSTRUMENTS.

WRITE, call, cable or telephone.

A. J. WALTER, Gatwick Airport, Horley, Surrey. Horley 1420 and 1510 (Ext. 105/6). Cables: Cubeng, London. [0268

FOR Sale.

28 Unused Aircraft Magnetos, Bendix-Scintilla Type DFLN/6, Spec. AN 9511 A 10.

MAYER, NEWMAN AND CO., LTD., 15, Arundel Street, London, W.C.2. [7092

RADIO Compass. New Lear ADF 12. Import duty into the United Kingdom fully paid. Available for inspection at Croydon. £450. Box No. 1747. [7084

ROLLASON AIRCRAFT AND ENGINES, LTD., CRO. 5151. For all Tiger Moth, Gipsy Major, Gipsy Queen and Gipsy Six Spares. Specialists in the overhauling of Gipsy engines. [0131

NIL-hour Gipsy Major I engines for immediate delivery. Apply for full details to Mitchell Aircraft, Ltd., The Airport, Portsmouth. Tel. 717641. [0351

PHILLIPS & WHITE, LTD., offer from stock Instruments and instrument parts. Navigational equipment, electrical components, airframe parts and hydraulic components and parts. Engine spares for de Havilland Gipsy Major and Queen series, also Armstrong Siddeley Cheetah IX, X, XV spares. Stock lists available. 61 Queen's Gardens, London, W.2. Tel.: Ambassador 8651, 2764. Cables: Gyrair, London. [0466

ENGINE Overhauls, Hants and Sussex Aviation Limited offer Britain's most comprehensive engine complete overhaul service, magneto overhaul service, and component and spares supply, De Havilland Gipsy range, Armstrong Siddeley Cheetah range, Cirrus range, Lycoming, Scarab and Continental. Most types available on exchange. Engines, components and spares shipped to all parts of the world. Address: The Airport, Portsmouth. Phone 73947. [0711

AIRCRAFT ACCESSORIES AND ENGINES WANTED

WANTED to buy, one or two electric starters completely overhauled, for Lycoming 0-290-3. Aerofoto, Torslanda Airport, Gothenburg. [7095

WYLLAN EQUIPMENT CO. require Lycoming 4-cylinder engines and spares, also wide range of spares and components of U.S.A. origin. 222 Waterloo Road, Manchester 8. Tel.: Broughton 4182. Grams.: Wyllavia. [0260

AIRCRAFT & ENGINE PARTS

DOUGLAS
LOCKHEED
PRATT & WHITNEY
WRIGHT
LYCOMING
U.S. RUBBER
GOODYEAR
ELECTRONIC PARTS

- IMMEDIATE ATTENTION
- PROMPT SERVICE
- FULL SATISFACTION

ATLANTIC AVIATION CORPORATION

Teterboro Airport, Teterboro, N.J., U.S.A. — Cable Address: Atlantic Teterboro

Mullard—Pressed Steel—G.E.C.

24 repeat orders

33 MACHINES

Over the years 10 Murad Dustless Grinders have been installed by Mullard, 8 by G.E.C., and no less than 15 by Pressed Steel. There could be no finer tribute to the machine. The Murad Dustless Grinder is unique. It embodies its own dust inhibitor rendering separate dust extraction plant unnecessary. It can be placed anywhere in the shop to suit the sequence of operations without endangering the slides of nearby precision machines. Murad Dustless Grinders are found in the machine shops of the Industrial Giants. Follow the lead of the leaders of British Industry and send for full details NOW ! Model E.G.8: 8" dia. wheels. Model E.G.16: 16" dia. wheels. Pat. Nos. 674,748.

Murad

DUSTLESS GRINDER

KEEPS ITS DUST TO ITSELF!

MURAD DEVELOPMENTS LTD.
Stocklake, Aylesbury, Bucks. Tel: 2691

MARSHALL

AIRPORT WORKS CAMBRIDGE

REQUIRED FOR "ON SITE"

SKILLED AIRFRAME FITTERS

Generous Allowances

Good Average Earnings

Write, Call or Phone

Cambridge 56291—Ext. 36

EMPLOYMENT OFFICER

The . . .

British Air Line Pilots Association

95 MOUNT STREET, W.1

Tel.: Grosvenor 6261

Membership open to all commercial and service Pilots. For full details concerning objects and particulars of membership please write to Secretary.

OUR HELICOPTERS FLY ALL OVER THE WORLD

Our fleet of helicopters is at your disposal anywhere in the world, any time. We also run a training school for pilots and engineers on Bell 47 and Sikorsky S55 helicopters. Ask for further details from:

OSTERMANS AERO, STOCKHOLM 7, SWEDEN
Cables: Ostermanaero, Stockholm

AIRCRAFT SPRING WASHERS

TO B.S. SPECIFICATION S.P.47

CROSS MFG. CO. (1938) LTD., COMBE DOWN, BATH

AIRCRAFT SERVICING

REPAIRS and C. of A. overhaul for all types of aircraft.—Brooklands Aviation, Ltd., Civil Repair Services, Sywell Aerodrome, Northampton. Tel.: Moulton 3251. [0307

AERIAL PHOTOGRAPHY

MORSE Film Developing Units and Film Dryers; Continuous Film Printers; Argon and Mason Contact Printers; Water Supply Kits; Glazing Machines; F.24 Spiral and Spool Developing Outfits; K.17; F.52, F.49; and F.24 Cameras, Mounts, Lenses, Magazines, Controls, Vacuum Pumps, Motors and Spares for above Cameras; 16 m/m and 35 m/m Cameras, Projectors and Spares. Also large quantity of Aerial Film (all sizes). A. W. Young, 47 Mildenhall Road, London, S.5. Tel.: AMHerst 6521. [0290

AGENTS

THE TIGER MOTH SPECIALISTS are still Rollason Aircraft and Engines, Ltd., of Croydon Airport. Tel.: CRO. 5151. [0134

BALL BEARINGS

NEW Ball and roller bearings, over 4,000,000 in stock in more than 4,000 types. Britain's largest stocks. Stock list available. Claude Rye, Ltd., 895-921 Fulham Road, London, S.W.6. RENown 6174 (Ext. 24). [0420

CAPACITY AVAILABLE

REPUTABLE London scientific instrument makers have capacity for high class precision assembly and manufacture of component parts and prototypes. Box No. 1665. [7073

KELLERING and profile milling in all metals. Send us your die blocks to copy from wood or plaster masters. Up to 5ft by 8ft max. size. We are die copiers to the trade.

ARMYTAGE BROS. (KNOTTINGLEY), LTD., The Foundry, Knottingley, Yorkshire. Tel.: Knottingley 2046. [0975

CLOTHING

R.A.F. officers' uniforms purchased; good selection of R.A.F. officers' kit for sale, new and reconditioned.—Fishers, Service Outfitters, 86-88 Wellington Street, Woolwich. Tel.: Woolwich 1055. [0567

CLUBS

HERTS AND ESSEX AERO CLUB, Stapleford Tawney Aerodrome. M.C.A. approved private pilot's licence course. Auster, Gemini and Tiger aircraft. Trial lesson 35s. 15 miles centre of London. Central Line Underground to Theydon Bois, bus 250 to club. Open every day.—Tel.: Stapleford 210. [0230

CONSULTANTS

R. K. DUNDAS, LTD., have been giving the correct answer to aviation problems for twenty years. Technical. Purchasing Operations. Marketing. 59, St. James's Street, London, S.W.1. HYDe Park 3717. [0560

CONTACT LENSES

MODERN CONTACT LENSES CENTRE 7(D.1), Endsleigh Court, W.C.1. Deferred Terms. Booklet sent. [0342

AMERICAN K20 AIRCRAFT CAMERA in fitted carrying case F4.5 lens

£15 . 0 . 0

Films available. K24, F24, F52, K8AB and other cameras and all accessories available from stock write:—

Air Survey Dept.

Harringay Photo Supplies

423 Green Lanes - - London, N.4

MOUntview 5241/2

FOR SALE

QTY. 6—STR9X Transmitter/Receivers. A.R.B. Released. Ex stock.—Staravia, Blackbushe Airport, Camberley. [0296

HELICOPTERS

HELICOPTER Charter. U.K. and Overseas. Autair, Ltd., 75 Wigmore Street, London, W.1. Telephone: Welbeck 1131. [0020

BELL Helicopter Type 47 D1. Airframe hours since new 2,400. Engine and airframe nil hours since 600 hour overhaul. Immediate delivery. Price: £9,000 excluding import duty. Autair, Ltd., 75, Wigmore Street, London, W.1. Telephone: WELbeck 1131. [0022

TUITION

AIR SERVICE TRAINING

The only fully equipped private School of Aviation. Specialist staff, comprehensive equipment and full residential and recreational facilities within the School ensure the soundest training for an aviation career.

M.T.C.A. APPROVED COURSES

for private and commercial pilots' licences and maintenance engineers' licence in categories "A" and "C".

HELICOPTER COURSES

for private and professional licences. Details available from the Commandant.

AIR SERVICE TRAINING, LTD.

Hamble, Southampton. Tel.: Hamble 3001/9. [0970

FREE! Brochure giving details of courses in all branches Aero Engineering covering A.F.R.Ae.S., M.C.A. exams, etc. Also courses for all other branches of engineering. Write: E.M.I. Institutes, Dept. F26, London, W.4. (Associated with H.M.V.) [0964

TUITION

Learn to fly at the

AIRWORK

School of Aviation

Perth, Scotland.

BRITAIN'S oldest and foremost private aviation organization offers M.T.C.A. Approved Courses for Private and Commercial Pilots' Licences and Instrument Rating.

SPECIAL Courses and Helicopter training arranged to meet individual requirements.

CLUB residential and recreation facilities.

Details from

AIRWORK LIMITED

(FLYING TRAINING DIVISION)

Langley Aerodrome, Slough, Bucks.

Tel.: Langley 520

or

The Manager, Perth Aerodrome, Scone, Scotland. [0712

LEARN to fly, £30; Instructors' Licences and Instrument flying, for £3 10s. per hour. Night flying £5 per hour. Residence 6 guineas weekly. Approved M.C.A. Private Pilots' Licence course. Specialized course for Commercial Pilot's Licence.—Wiltshire School of Flying, Ltd., Thruxton Aerodrome (Andover Junction 1 hour 15 minutes from Waterloo), Hants. [0253

TUITION

City of London

SIR JOHN CASS COLLEGE

Department of Navigation

Jewry Street, Aldgate, E.C.3.

INSTRUCTION and preparation for Pilots' and Navigators' Licences.

	Fee
COMMERCIAL PILOT	£8
SENIOR COMMERCIAL PILOT ...	£12
AIRLINE TRANSPORT PILOT ...	£16
FLIGHT NAVIGATOR	£20

Write, call or telephone (Royal 3383) for prospectus. [0294

CIVIL PILOT/NAVIGATOR LICENCES

AVIGATION, LTD., provides full-time, or intermittent instruction and postal tuition, or a combination of any of these methods to suit individual requirements for the above licences. Classroom instruction can be provided for A.R.B. General, certain Specific Types and Performance Schedule examinations. Link training Dept. at MONarch 1364.

FOR full details apply to The Principal.

AVIGATION, LIMITED

30 Central Chambers, Ealing B/Way, London, W.5. Tel.: Ealing 8949. [0248

A SUCCESSFUL career for your son.

AERONAUTICAL, technical and practical training for all branches of aeronautical engineering. Diploma course leads to executive appointments in civil aviation design and development, draughtsmanship, maintenance, etc. Extended courses to prepare for A.F.R.Ae.S., and A.M.I.Mech.E. examinations. Write for prospectus to Engineer in Charge, College of Aeronautical Engineering, Chelsea, London, S.W.3. FLAxman 0021. [0019

A.F.R.Ae.S., A.R.B. Certs., A.M.I.Mech.E., etc., on "no pass, no fee" terms. Over 95 per cent success. For details of exams. and courses in all branches of Aeronautical work, Navigation, Mechanical Engineering, etc., write for 144-page handbook—free.—B.I.E.T. (Dept. 702), 29 Wright's Lane, London, W.1. [0707

BLACKBURN AND GENERAL AIRCRAFT LIMITED

The Engine Division of the Company is extending its activities into the industrial gas turbine field and requires an

ASSISTANT CHIEF DESIGNER

to take control of various interesting projects at present in the design and development stages. Applicants should have had design experience in small packaged power units, either in the gas turbine, steam turbine or diesel engine fields. Preferred age 35-45.

Write, giving full details of experience and qualifications to:

The General Manager (Engine Division), BLACKBURN AND GENERAL AIRCRAFT LIMITED, Brough, East Yorks.

MARSHALL

AIRPORT WORKS CAMBRIDGE

DESIGN & DRAWING OFFICE

PUBLICATIONS SECTION

REQUIRE

RADIO RADAR MECHANIC

with theoretical knowledge and ability to write reports.

TECHNICAL AUTHORS

TECHNICAL ILLUSTRATORS

Ex R.A.F. W/O. or N.C.O. Fitters (AIRFRAME & ELECTRICAL (AIR)) with a flair for Publication Work are invited to apply for vacancies offering

GOOD CAREER PROSPECTS.

Apply in writing, giving full details of Experience and Convenient dates for interview to

PERSONNEL MANAGER.

THE FAIREY AVIATION CO. LTD.

An

AERONAUTICAL ENGINEER

specialized in Aerodynamics or Aircraft Structures is required for our Special Projects Division at Salisbury, South Australia. A degree in Aero. Engineering or equivalent is essential and at least five years' experience in industry or research and/or development organization is desirable. Salary in region of £A1,250 p.a.

Please apply to the

Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middlesex.

BROOKLANDS AVIATION LIMITED

require

AIRCRAFT ELECTRICIANS

with experience on CANBERRA AIRCRAFT

PIECEWORK BONUS — CANTEEN FACILITIES

Apply in first instance to:—

No. 2 SITE, BUTTOCKS BOOTH, MOULTON, NORTHAMPTON

MINISTRY APPROVED COURSES FOR

COMMERCIAL PILOT — INSTRUMENT RATING

All subjects for professional licences and ratings, including Academic, Technical, simulated and practical flying. Home-Study excellent alternative.

- Individual coaching
- Refresher Courses
- Officially appointed by the Institute of Army Education for Forces Correspondence Scheme

Full details from your Station Education Officer, or

London School of Air Navigation Ltd.

11 Ovington Sq., Knightsbridge, London, S.W.3

KEN 8221 Flying Base: Croydon Airport

TUITION

SURREY Flying Club, Croydon Airport, M.C.A. approved for private pilots' licences. Open seven days a week. Croydon 7744. [0293

SOUTHEND-ON-SEA Municipal Air Centre and Flying School. Comprehensive training for all pilots' licences, ratings and endorsements. Special facilities for instrument, night-flying and commercial pilot licences. Chipmunk aircraft. Link training to full instrument rating standard. No entrance fee or subscriptions. M.T.C. approved 30-hour course. Municipal Airport, Southend-on-Sea, Essex. Rochford 56204. [0453

PACKING AND SHIPPING

R. AND J. PARK, LTD., 143/9 Fenchurch St., E.C. Tel.: Mansion House 3083. Official packers and shippers to the aircraft industry. [0012

PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM East Anglian Flying Services, Ltd., of Southend Airport, Essex:—

APPLICATION No. 350/1 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate on the route Ipswich-Southend-Le Touquet with DH89A and Dove aircraft at a frequency of two return flights daily from April to October inclusive each year until March 31, 1961, so as to permit operation at a frequency in accordance with traffic demand.

APPLICATION No. 546/2 for an amendment to the terms of approval of the U.K. Internal Service which they are authorized to operate on the route Portsmouth-Guernsey (opt.)-Jersey with DH Dove and DH89 aircraft at a frequency of up to six return flights weekly from June to September inclusive each year until March 31, 1960, so as to permit operation at a frequency of two return flights daily on Mondays-Thursdays inclusive and 12 return flights between Fridays and Sundays inclusive.

APPLICATION No. 5/4 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate on the route Ipswich (opt.)-Southend-Ostend from Whitsun to September inclusive each year until March 31, 1960, for the carriage of passengers only, so as to permit the carriage of supplementary freight on the service.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on May 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [7093

MARSHALL

AIRPORT WORKS CAMBRIDGE

VACANCIES AT CAMBRIDGE

for

SKILLED AERO ELECTRICIANS

Required for installation and testing Electrical Systems in Civil and Service Aircraft. Also

SKILLED AIRFRAME FITTERS

Good Average Earnings.

Single Lodging Accommodation Available

Write, Call or Phone:

Cambridge 56291—Ext. 36

EMPLOYMENT OFFICER

PUBLIC APPOINTMENTS

MINISTRY OF TRANSPORT AND CIVIL AVIATION

OPERATIONS OFFICERS

APPLICATIONS are invited for at least 8 unestablished posts, which may become permanent and pensionable. Appointment to Grade III or II if qualifications and experience are outstanding. Age at least 23 on 1st July, 1957.

Candidates must have had a good basic education; preferably H.S.C., with a pass in at least one mathematical or scientific subject or G.C.E., or equivalent, with appropriate passes in English and four other subjects, including two of the following: mathematics or scientific subject or a modern foreign language. Associate Fellowship of the Royal Aeronautical Society accepted in lieu of the academic qualifications.

All candidates must have had considerable recent experience as pilot or navigator in civil air transport and have held a Senior Commercial Pilot's or Flight Navigator's Licence, but exceptionally extensive flying and considerable recent experience in other operational fields of aviation may be accepted instead.

The following will be advantages: (i) organising experience; (ii) general knowledge of civil aviation legislation and practice, aerodrome planning and radio and radar aids to navigation; (iii) working knowledge or French or Spanish. Service anywhere in U.K. and liability to service overseas.

Grade III salary (London) on entry £720 (at age 23) up to £995 at age 32 or over. Scale maximum £1,035. Grade II £1,110-£1,445. Women's scales somewhat lower but being increased each year to reach equality with men's in 1961. Rates outside London somewhat lower. Promotion prospects to Grade 1 (£1,510-£1,825).

PARTICULARS and application forms from Secretary, Civil Service Commission, 6 Burlington Gardens, London, W.1, quoting No. 4760/57. Completed application forms should be returned by 10th October, 1957. [7088

Applications are invited for pensionable posts as

EXAMINERS

in the

PATENT OFFICE

TO undertake the official scientific, technical and legal work in connection with Patent applications. AGE at least 21 and under 35 years on 1st January, 1957 with extension for regular Forces' service. CANDIDATES must have (or obtain in 1957) 1st or 2nd Class Honours in Physics, Organic or Inorganic Chemistry, Mechanical or Electrical Engineering or in Mathematics, or an equivalent qualification, or have achieved a professional qualification, e.g. A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.R.I.C. For a limited number of vacancies candidates with 1st or 2nd Class Honours degrees in other subjects—scientific or otherwise—will be considered. Exceptional candidates otherwise qualified by high professional attainments will be considered.

STARTING pay for 5-day week of 42 hours in London between £605 and £1,120 (men) according to post-graduate (or equivalent) experience and National Service. Maximum of scale £1,345. This salary scale is being increased by approximately 5 per cent. Women's pay above £605 slightly lower but is being raised to reach equality with men's in 1961. Good prospects of promotion to Senior Examiner rising to £2,000 (under review) and reasonable expectation of further promotion to Principal Examiner.

APPLICATION form and further particulars from Civil Service Commission, Scientific Branch, 30 Old Burlington Street, London, W.1, quoting S 128/57 and stating date of birth.

INTERVIEW Boards will sit at intervals, as required. Early application is advised. [7058

SITUATIONS VACANT

A FLIGHT ENGINEER

A. and C. Licences Dakota (DC3) P. and W., R 1830-92, not over 35 years of age, is required for major oil company operating Indonesia. Salary £1,548 p.a., plus board and lodging, medical attention, paid local and home leaves, and participation in pension plan. Apply in writing with full particulars to

CALTEX SERVICES LIMITED,

Caltex House,
Knightsbridge Green,
London, S.W.1. [7078

AN Engineer is required for a responsible position on the Head Office Staff of a well-known firm specializing in the manufacture of high-pressure valves and couplings. Preferred age range is 24-30. Applicants with commercial or administrative experience and interests are invited to submit brief details of their general education, technical training and experience to Ref. FKM, British Ermeto Corporation, Ltd., Hargrave Road, Maidenhead, Berks. [7061

SENIOR Aeronautical Engineer with varied production and design experience required for aircraft establishment in Israel. Apply Aviation Department, Ministry of Defence Mission, 2a, Palace Green, London, W.8. [7085

SITUATIONS VACANT

CITY AND COUNTY OF BRISTOL

BRISTOL (LULSGATE) AIRPORT

APPLICATIONS are invited for the following appointments—

(a) One Senior Telecommunications Officer
(b) Six Air Traffic Control Assistants
(c) Two Radio Tech/Electricians.

SALARIES in accordance with the following National Joint Council Scales (subject to confirmation of new scales).

(a) A.P.T. II: £725/845
(b) and (c) Misc. IV: £540/620.

CANDIDATES for the S.T.O. post should possess a sound knowledge of electricity and radio and have had practical experience in the maintenance and working of VDF, SBA and radar equipment.

CANDIDATES for the A.T.C.A. posts must be trained Radio/Teleprinter Operators and have experience of the duties of Control Assistants.

CANDIDATES for the Radio Tec/Electricians posts must have working knowledge of radio aids and general electrical experience.

APPLICATIONS should be forwarded immediately to:—

The Airport Manager,
Bristol (Lulsgate) Airport,
Bristol. [7102

VACANCY FOR GENERAL MANAGER

CENTRAL AFRICAN AIRWAYS CORPORATION

CENTRAL AFRICAN AIRWAYS invites applications for the post of General Manager. The successful applicant will be required to commence duty on 1st January, 1958. Salary will be in accordance with experience and qualifications.

APPLICATIONS should be addressed to the Secretary, Central African Airways, Salisbury, Southern Rhodesia, so as to arrive not later than 31st October, 1957. Envelopes should be endorsed

"Confidential—General Manager's Post."

[7098

SILVER CITY AIRWAYS, LTD.

INVITE applications from radio engineers for immediate vacancies Overseas Airfields. Preference given technical qualifications and knowledge V.O.R., I.L.S., high powered transmitters and receivers.

GOOD progressive salary and allowances. Accommodation provided or allowance in lieu. Generous family and leave travel.

APPLY writing giving details age, full experience, to Group Personnel Officer, 1 Gt. Cumberland Place, W.1. [7086

PILOTS. Those who believe their future lies in flying commercially operated Helicopters should apply, stating age and flying experience, to Box No. 1658. [0998

HONG KONG AIRCRAFT ENGINEERING CO. have vacancies for two Maintenance Engineers. Essential qualifications include adequate training, five years experience minimum and possession of an "A" and "C" category licence on modern pressurized aircraft. Preference will be given to applicants holding licences on Constellation 1049 or 749, Viscount or DC6 aircraft. Monthly salary £106 at commencement, plus £36 marriage allowance. Sickness and provident fund operated, accommodation and essential furniture provided. Three year contract initially but position permanent. Apply giving full details precise training and experience, including positions previously held, to Matheson & Co., Limited, 3 Lombard Street, London, E.C.3. Final interview London. [7029

SILVER CITY AIRWAYS LIMITED

Invite applications from undermentioned for immediate vacancies Overseas Airfields.

AIR TRAFFIC CONTROL OFFICERS

holding M.T.C.A. Certificate of Competency.

SIGNALS OFFICERS

Good progressive salary and allowances. Accommodation provided or allowance in lieu. Generous family and leave travel.

Apply writing giving details age, full experience to

Group Personnel Officer,
1, Gt. Cumberland Place, W.1.

A. V. ROE & CO. LIMITED
WEAPONS RESEARCH DIVISION
(GUIDED MISSILES)
WOODFORD . CHESHIRE

have vacancies in their

TRIALS DEPARTMENT

for the following

1 SENIOR ENGINEERS

to be responsible for design and development of instrumentation and monitoring systems.

2 SENIOR ENGINEERS

to develop service test equipment.

3 MECHANICAL AND ELECTRONIC TECHNICIANS

to operate in Trial Teams both in U.K. and Australia.

4 TECHNICIANS

for environment testing.

5 DRAUGHTSMEN

to form part of development teams.

The work is concerned with the development of a guided weapon project and for Post 3 willingness to travel to and from Australia is essential.

QUALIFICATIONS: *Posts 1 and 2—H.N.C. Standard*
Posts 3-5 —Preferably O.N.C. Standard

Previous experience is not necessary providing that initiative is shown and that candidates are willing to work with a minimum of supervision.

The Division is situated within easy access of Manchester and the Derbyshire Hills, and the company provides excellent canteen facilities and a superannuation scheme.

Applications should be addressed as follows:—

Posts 1 and 2
THE CHIEF ENGINEER,
WEAPONS RESEARCH,
A. V. ROE & CO. LIMITED,
WOODFORD, CHESHIRE.

Posts 3, 4 and 5
THE PERSONNEL MANAGER,
A. V. ROE & CO. LIMITED,
GREENGATE,
MIDDLETON, MANCHESTER.

Quoting Reference WRD/HWL/R14/F.

SITUATIONS VACANT

WEST AFRICAN AIRWAYS CORPORATION, Lagos, have vacancies for:—
(a) Aircraft and Engine Maintenance Engineers;
(b) Engine and Power Plant Overhaul Engineers.
Essential qualifications should include:—
(a) An Engineering Apprenticeship or other recognized course of technical training;
(b) At least ten years' practical experience in the maintenance of modern aircraft and/or their engines. Similar experience with the overhaul of aero-engines and their accessories;
(c) Possession of an Aircraft Maintenance Engineer's Licence issued by the Ministry of Transport and Civil Aviation, London, valid in one or more of Categories "A," "C" or "D" endorsed as applicable for equipment used by the Corporation.
PREFERENCE will be given to Engineers with licence cover on DC-3, Dove and Heron aircraft and associated engines, and to Engineers with "D" licence cover on the Gipsy Queen 30 Mk II engines or variants.
CONSIDERATION will also be given to Engineers with Argonaut or Stratocruiser Airframe and/or Engine Licences or experience, who are able to extend their licence to cover small types in due course.
SALARY scale £1,317 to £1,625 per annum, according to experience, which includes Expatriation Pay.
FREE fully furnished accommodation is provided. Leave at the rate of one-fifth of tour in West Africa which is normally 15 months. Free passages for wife and up to two children. Education allowance. Contributory pension scheme.
APPLICATIONS should be addressed to European Representative, West African Airways Corporation, 32 New Bond Street, London, W.1, to arrive not later than September 30, 1957. [7097

ONE engine/airframe mechanic with A and C Licence or experience on four engine American type commercial aircraft. Applications in writing only to Assistant Regional Maintenance Superintendent, Trans-Canada Air Lines, London Airport, Hounslow, Middx. [7082

SABENA BELGIAN WORLD AIRLINES wish to recruit Flight Engineers for service in DC4 and DC6 aircraft. Maximum age 30. Application with full details of education, qualifications and previous experience, should be addressed to Personnel Dept., Sabena, Melsbroeck Airport, Brussels, Belgium. [7079

CHIEF Planning Engineer. Applications are invited from suitably qualified engineers in machining, sheet metal and main and detail fitting to take charge of department in a growing division of well-known company in West Surrey. Salary from £1,500 according to experience and qualifications. Write in strictest confidence to Managing Director. Box No. 1664. [7072

HANDLEY PAGE (READING), LTD., The Aerodrome, Woodley, Reading, have vacancies for Senior and Intermediate Draughtsmen for interesting work on Civil Aircraft. High commencing salaries are offered and a generous Life Assurance and Superannuation Scheme is in operation. Please send full particulars of experience, etc., to the Personnel Officer. [0284

WORKS MANAGER required for Home Counties engineering factory. Must have had previous mass production experience of engineering components and assembly. Excellent opportunity for top qualified man. Salary commencing at £2,000 according to qualifications and past experience. Write in strictest confidence to Managing Director. Box No. 1663. [7071

DESIGN Draughtsman required by light mechanical and hydraulic engineers in Berkshire. Minimum qualifications should include O.N.C. and apprenticeship or other practical training. The position offers a good salary, pension fund and pleasant working conditions. Applications, which will be treated in confidence, should be addressed to Ref. FKM., British Ermeto Corporation, Ltd., Hargrave Road, Maidenhead, Berks. [7063

CATERING Superintendent required for air transport company to control all aspects of company's aircraft catering, cabin services, ground catering and passenger overnight accommodation. Previous varied experience in air transport industry desirable. Position calls for individual with progressive ideas and ability to achieve economic results. Salary according ability and experience. Apply giving full details past experience and salary required to Commercial Manager, Hunting-Clan Air Transport, Ltd., London Airport, Hounslow, Middx. [7080

YOUNG Technical Executive required for interesting and responsible position on the commercial staff of hydraulic and light mechanical engineering firm in Berkshire. Candidates must have received a sound general education followed by technical training to Degree or H.N.C. standard. Subsequent industrial experience will be considered in assessing remuneration of successful applicant, which will be on a generous scale. Please write giving brief details of qualifications in first instance to Ref. FKM. British Ermeto Corporation, Ltd., Hargrave Road, Maidenhead, Berks. [7062

WEST AFRICAN AIRWAYS CORPORATION require Pilots as First Officers based in West Africa. Essential qualifications: Commercial Pilot's Licence, Instrument Rating, R.T. Current civil airline experience preferably on DC3, Heron and Rapide. Salary, according to qualifications and experience, in range £1,850 to £2,130. Free furnished quarters; car and education allowances; free passages for wife and up to two children; generous contributory pension scheme; low income tax.
APPLICATIONS to be sent to the European Representative, West African Airways Corporation, 32 New Bond Street, London, W.1. [7099

SITUATIONS VACANT

TECHNICAL Writers urgently required for interesting and varied work on gas turbine engines. Must be able to understand moderately complicated graphs and technical diagrams associated with hydraulics, etc., and National or Higher National Certificate an advantage. Applications from men inexperienced as technical writers, but with a good engineering background considered.

POSITIONS are permanent and pensionable.

SALARY, £16-£20 depending on ability.

APPLICATIONS with full details to Box No. 1742, quoting reference TDW. [7077

S. SMITH AND SONS (ENGLAND), LIMITED, require a Spares List Compiler in the Technical Services Spares Department for work on general aircraft instruments. Sound engineering background and practical experience essential. Preference will be given to applicants with drawing office experience. Apply Personnel Manager, Bishop's Cleeve, Nr. Cheltenham. [7096

HANDLEY PAGE (READING), LTD., The Aerodrome, Woodley, Reading, have vacancies for Senior Stress Engineers, with wide practical experience, for interesting work on Civil Aircraft. High commencing salaries with new houses to rent will be offered to those appointed. Life Assurance and Superannuation Scheme in operation. Please send full particulars of experience, etc., to the Personnel Officer. [0285

SITUATIONS VACANT

REPRESENTATIVE/Salesman required having good contacts with manufacturers/operators/embassies to sell surplus origin instruments, ancillaries, ground equipment, and aircraft spares. Box No. 1551. [7042

CAPTAINS and First Officers required for small sprouting airline in friendly Middle East country, with experience on Dakotas or similar aircraft. Write Box No. 1804, with full details of experience and salary required. [7101

PRODUCTION Controller for aircraft factory in Scotland. Must have experience of planning, shop-loading and progress in the aircraft industry. Good salary with superannuation benefits. Assistance with housing. Box No. 1803. [7100

SENIOR and Junior Draughtsmen required for interesting work on position instruments for guided missile project. Senior men must have had experience in light mechanical or instrument design and production experience would be an advantage. Some practical experience is essential. Technical qualifications to H.N.C. are required for senior position. Detailing draughtsmen should have O.N.C. or equivalent. Excellent working conditions in new drawing office at Harrow.

ALL applications treated confidentially and interviews arranged to suit applicant. Apply: Administrative Manager, A. V. Roe and Co., Ltd., 2 College Road, Harrow, Middlesex. Telephone, Harrow 8431. [7094

SITUATIONS VACANT

VISCOUNT "A" and "C" licensed Engineer for senior technical position in charge of Viscount maintenance at Manchester Airport. "A" and "C" licence on Viking also an advantage.

MAINTENANCE Schedules Engineer. Preferably with Viscount and Viking experience to work with Chief Inspector, Blackbushe Airport.

APPLY in confidence to Managing Director, Eagle Aircraft Services, Ltd., Blackbushe Airport, Camberley, Surrey. Yateley 2371. [7057

SITUATIONS WANTED

B.Sc. (Agric.), 26, five years' farming experience, requires position combining interests in agriculture and flying. Box No. 1749. [7083

COMMERCIAL Pilot wants flying job, any place considered.—H. Janssen, 22 Munday Way, Medina, W.A., Australia. [7087

PILOT, 27, 1,130 hours, final stages C.P.L., seeks any position in aviation. Goss, 10, Beeches Ave., Carshalton, Surrey. [7090

COMMERCIAL Pilot, recently qualified, requires flying job, anywhere, anything considered. Heinz Lichius, 12, Gawler Way, Calista, W. Australia. [7076

EX-F.A.A. Pilot, S.C.P.L., DC3 technical, seeks freelance employment. Any type of flying considered. Swanson, Landue Barton, Launceston, Cornwall. Tel.: Launceston 487. [7091

WEIGHT ENGINEER

A vacancy exists for a senior Weight Engineer to be engaged primarily on weight analysis and research duties. Some experience in project weight engineering is essential and an educational standard of H.N.C. (or equivalent) is required.

The successful candidate, who will deal with problems associated with high performance aircraft, can be assured of interesting and varied work demanding considerable personal initiative.

Write giving full particulars and quoting reference No. 3503 to the

Personnel Officer,
Vickers-Armstrongs (Aircraft) Ltd.,
South Marston Works,
Nr. Swindon, Wilts.

BLACKBURN AIRCRAFT

urgently require

AIRCRAFT AND MECHANICAL DRAUGHTSMEN,
STRESSMEN, WEIGHT CONTROL ENGINEERS
AND
TECHNICAL PUBLICATIONS STAFF

TECHNICIANS OF ALL CATEGORIES

Blackburns are an expanding organisation. At Brough one additional modern building for Design Staff is now nearly completed and work on another still larger building will commence within the next few weeks.

The Factories and Technical Offices are situated on the North bank of the Humber amid delightful open countryside.

Houses are available and generous assistance to purchase is given together with payments of removal expenses.

We invite you to join us, either at the main offices in Brough, or at our design offices in London, Leeds or Dumbarton (Scotland).

Enquiries, which will be treated in the strictest confidence, should be marked for the attention of the Technical Staff Manager and sent to

BLACKBURN AND GENERAL AIRCRAFT LIMITED
BROUGH, EAST YORKS.

INDEX TO ADVERTISERS

	Page
Allison Engines	Cover iii
Atlantic Aviation Inc.	22
Bellman Hangars, Ltd.	2
Blackburn and General Aircraft, Ltd.	23, 26
Boulton Paul Aircraft, Ltd.	1
Briggs Motor Bodies, Ltd.	Cover ii
Bristol Aircraft, Ltd.	Cover iv
British Air Line Pilots Association, Ltd., The	22
British European Airways ...	Facing Edit. Page 493
British Oxygen Aro Equipment, Ltd.	5
Brooklands Aviation, Ltd.	23
Carr Fastener Co., Ltd	20
Central Office of Information (R.A.F.)	Between Edit. Pages 488/9
Cross Manufacturing Co. (1938), Ltd.	21, 22
De Havilland Aircraft of Canada, Ltd.	3
De Havilland Enterprises, Ltd., The	Facing Edit. Page 481
Dunlop Rubber Co., Ltd.	18
English Electric Co., Ltd., The	Facing Edit. Page 479
Fairey Aviation Co., Ltd., The	23, Facing Edit. Page 480
General Electric Co., Ltd., The	Facing Edit. Page 489
Gloster Aircraft Co., Ltd.	Cover I
Harringay Photo Supplies	22
Hong Kong Aircraft Engineering Co., Ltd., The	Facing Edit. Page 489
Lewis, Ltd., D.	21
London School of Air Navigation	23
Lucas (Gas Turbine Equipment), Ltd., Joseph	Facing Edit. Page 492
Marshall's Flying School, Ltd.	22, 23, 24
Martin-Baker Aircraft, Ltd.	Facing Edit. Page 488
Murad Developments, Ltd.	22
Napier and Son, Ltd., D.	19
Ontario Government Immigration Dept.	20
Osterman's Aero	22
Page Engineering Co.	4
Roe and Co., Ltd., A. V.	25
Rolls-Royce, Ltd.	6
Rotax, Ltd.	Facing Edit. Page 478
Samlesbury Engineering, Ltd.	21
Shackleton, Ltd., W. S.	21
Silver City Airways, Ltd.	24
Teddington Aircraft Controls, Ltd.	2
Vickers-Armstrongs (Aircraft), Ltd.	4, 17, 26

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. Flight can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd., Gordon & Gotch Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: Eastern News Co., 306 West 11th Street, New York 14

How to cut costs on 75% of all flights . . .

ALLISON PROP-JET POWER

Lockheed Electra powered by four Allison Model 501 Prop-Jet Engines with Aeroproducts Turbo-Propellers.

THE MATCHED TEAM of Allison Model 501 Prop-Jet engines and Aeroproducts Turbo-Propellers is the most advanced aircraft power of its type available anywhere in the world today!

THE EFFICIENCY of the Aeroproducts Propellers allows take-offs and landings in small airports, with runway to spare — brings cost-cutting speed to the 200-to-500 mile flights which comprise most air travel. Its efficient use of low-cost prop-jet fuel makes the Allison engine economical for longer flights, too — up to 2,500 miles non-stop!

ALLISON PROP-JET POWER delivers 400-mile-an-hour speeds . . . trims flight schedules by as much as 30%. The weight saved in four Allison engines equals the weight of 52 passengers, plus baggage — providing a more profitable power-to-weight ratio than any other prop-jet engine!

ITS PROVED PERFORMANCE AND COST-CUTTING ABILITY have made Allison the logical choice to power new fleets of Lockheed Electras for such leading airlines as: *KLM Royal Dutch, Braniff International, American, Eastern, National and Western.*

ALLISON PROP-JET POWER

. . . Backed by the worldwide resources of . . .

GM
GENERAL MOTORS

DIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd., Gordon & Gotch Ltd. A.). Ltd. UNITED STATES: Eastern News Co., 306 West 11th Street, New York 14

PHOTOGRAPH "THE AEROPLANE"

INTER-CITY—TRANS-POLAR

only the Britannia makes money on such a wide variety of routes

The airliner ideally suited to almost any stage length . . . short or medium or long.

The airliner that makes money on so many different routes . . . on inter-city, trans-continental . . . or even the longest trans-oceanic flights.

The airliner that outperforms all other aircraft in service today—the Bristol Britannia is the world's largest, fastest, quietest, turboprop transport.

Its record shows it to be the most versatile airliner ever to fly. It has no noise, runway, or traffic-control problems. Its remarkable flexibility allows it to use existing traffic patterns and runways almost anywhere in the world.

Operators have already chosen Britannias for a remarkable variety of stage lengths, from 200-mile inter-city routes to 4,500-mile trans-polar flights. Britannias will be flown between New York and Washington and New York-Miami by Northeast; between Havana and New York by Cubana; and between Mexico City and New York by Aeronaves.

The same type of aircraft will be flown non-stop across the Atlantic by BOAC and El Al, and on trans-polar and trans-Pacific routes by Canadian Pacific.

Powered by four 4,120-hp Bristol Proteus turboprop engines, the Whispering Giant cruises at 400 mph, carries up to 133 passengers and cuts operating expenses to a new minimum.

Britannias are in service on BOAC routes spanning four continents and have been ordered by Aeronaves de Mexico, Canadian Pacific, Cubana de Aviacion, El Al Israel Airlines, Hunting-Clan Air Transport, Royal Air Force Transport Command and The Ministry of Supply.

BRISTOL
Britannia

BRISTOL AIRCRAFT LIMITED